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Cover

A representation of *Nuytsia floribunda* (Labill.) R.Br. ex Fenzl—the Western Australian Christmas Tree. The journal is named after the plant, which in turn commemorates Pieter Nuijts, an ambassador of the Dutch East India Company, who in 1627 accompanied the "Gulde Zeepard" on one of the first explorations along the south coast of Australia.

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Western Australian Herbarium, George St, South Perth,
Western Australia 6151.

Taxonomic studies on *Ptilotus* R.Br. (Amaranthaceae) in Western Australia

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Abstract

Benl, G. Taxonomic studies on *Ptilotus* R. Br. (Amaranthaceae) in Western Australia. Nuytsia 4 (3): 263-274 (1983). One new species and two new varieties of Western Australian *Ptilotus* are described and discussed: *P. procumbens, P appendiculatus* var. *minor* and *P. astrolasius* var. *luteolus*. The new species, only known from near Boulder in the Coolgardie Botanical District, is illustrated by analytical drawings of the flower; a photograph of the type specimen is provided. The *P. polystachyus* complex is discussed and clarified with the aid of figures and a key: *P. pullenii* Benl is reduced in rank to *P. polystachyus* var. *pullenii* (Benl) Benl and *P. polystachyus* var. *longistachyus* (W. V. Fitzg.) Benl is reinstated.

1. **Ptilotus procumbens** Benl, sp. nov. (Figures 1 and 2)

Planta annua humilis caulibus numerosis caespitosis, 3-10 (18) cm longis, mox procumbentibus, parce ramosis; primo leviter hirsuta denique plus minusve glabrescens. *Folia caulina* alterna (lineari-)lanceolata vel anguste obovata, ad c. 3 x 0.6 cm (basalia longe alati-petiolata maiora marcescentia), cuspidata. *Inflorescentiae* maturae (elongati-)conicae, ad 1.8 x 1 cm; *flores* 15-45, conferti, subcampanulati, primo purpurei dein viriduli, apicibus albidis glabris dentatis recurvatis tepalorum pilosorum (praesertim exteriorum) insignes; *bracteae* fuscae. Quatuor *stamina* fertilia; *filamenta* brevia in tubum staminalem longum transeuntia. *Ovarium* glabrum; *stylus* brevis crassiusculus.

Taxon novum a speciebus adhuc descriptis praecipue ob habitum procumbentem, ob inflorescentias conicas, structuram conspicuam tepalorum atque androecei recedit.

Typus: Kambalda Road, Boulder, Western Australia. "Low spreading (radially) herb, 10 cm. Flower spike pink-white." 19 Nov. 1978, *R. J. Cranfield* s.n. (holo: PERTH; iso: AD, CANB, K, M, MEL, NSW, PERTH).

The available specimens do not give evidence of a perennial habit. *Shoots* up to 50 (or more) arising from a central tap-root of up to 5 mm in diam., thick, at first erect, then spreading and soon becoming prostrate. *Stems* slender, weak, wiry, greyish-green with (slightly) angular reddish ribs which turn brownish red with age, clothed with curved to crumpled jointed hairs 1.2 mm long, indumentum ultimately restricted to apices and leaf axils; floriferous stems in large specimens (Figure 1A) ranging in length from 3 cm to about 10-18 cm towards the border of the rosette; longer stems weakly branched from upper leaf axils 1-3.5 cm apart, with flexuose to ascendent branchlets to 2.5 cm long whose apices always becomes peduncles and rachises of spikes. *Radical leaves* (10-20) elongate-spathulate, to 7 cm long and 0.7 cm broad, forming a rosette of up to 14 cm diameter, soon withering; *petiole* winged, about as long as the lamina. *Cauline leaves* c. 3-8 per stem, (08)1.3-2.5(3.2) cm long and about

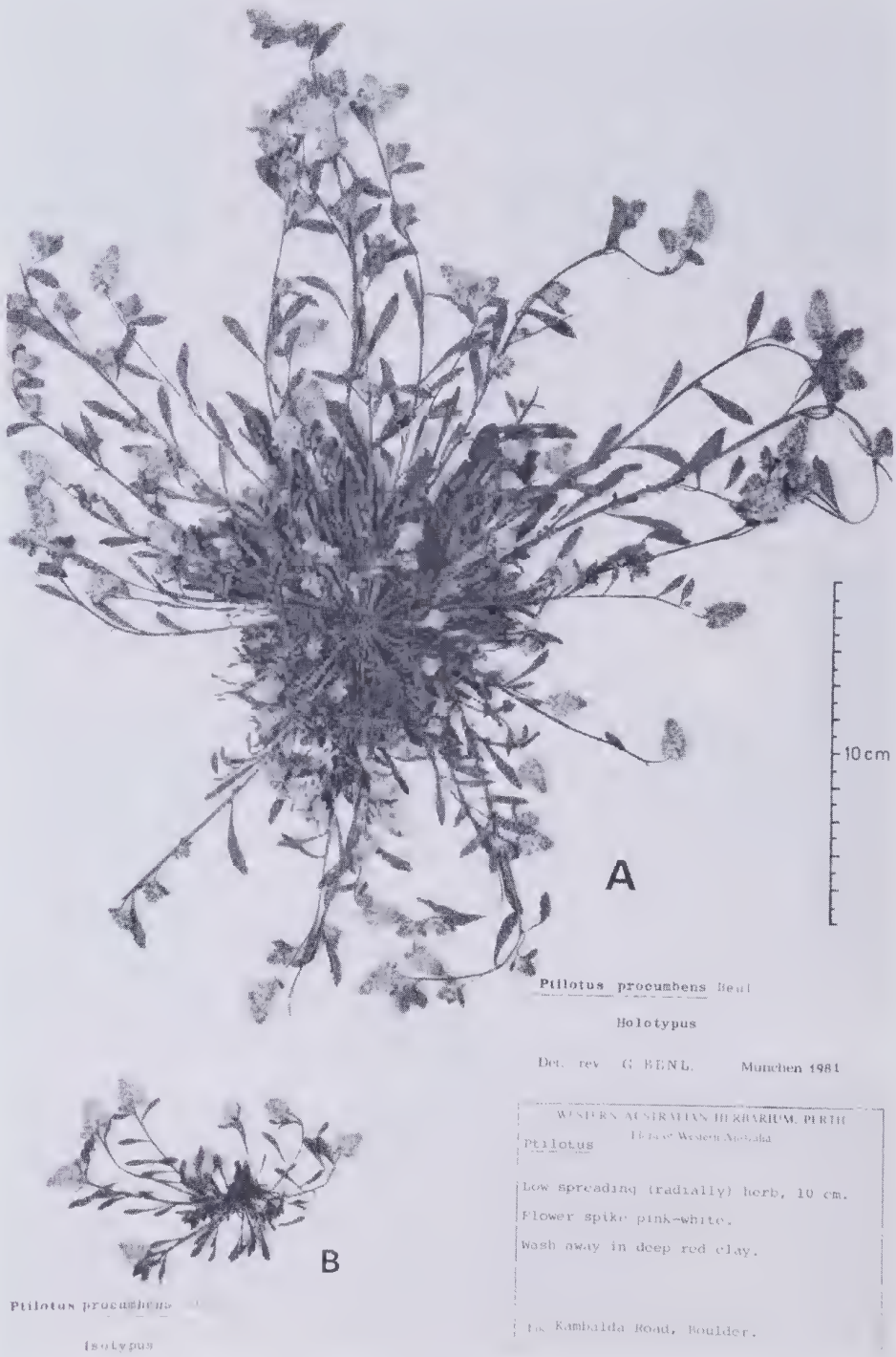

Figure 1. *Ptilotus procumbens* Benl. A—Holotype specimen (*R. Cranfield* s.n., PERTH). B—Part of an isotype sheet (M). (Photograph K. Liedl).

2.5-6 mm broad, (linear-)lanceolate to narrow-obovate, slightly coriaceous, deep green on both surfaces, with a light brown excurrent point c. 1 mm long, midrib on lower surface prominent and dark coloured; *petiole* variable in length, flattened and somewhat winged especially in lower leaves, often undulate on margins when dry, villous only in young state with hairs as for stems. *Spikes* c. 10-50 per plant, always solitary, compact, terminal on stems and branchlets (Figure 1), lateral and subsessile in upper leaf axils when very young; initially upright then upturned at apices of procumbent stems and branchlets, at first ovoid-conical, 0.8-1.0 cm long, 0.7-0.8 cm wide (Figure 2A), at length oblong-conical, attaining fully 1.8 cm long and 1 cm wide. *Rachis* slightly zigzag, 0.3-0.5 mm diameter, densely tomentose, the hairs white and denticulate-nodose, shorter hairs crisp, longer hairs almost straight and 0.8-2 mm long, obscuring pedicels and basal part of flowers. *Flowers* 15-45 per spike; lowest flower on longer spikes sometimes up to 2 mm from base. *Flower-axis* articulate above bracteoles. *Bracts* and *bracteoles* concave, appressed to and 3/4 to more than 4/5 as long as perianth, ovate-lanceolate, tapering into acuminate points up to 0.5 mm long, shining inside, pilose outside with denticulate-nodose hairs 0.5-1.5 mm long, margins entire or weakly and irregularly dentate towards the apex. *Bracts* (2.6) 3-3.6 (4.2) mm long, 1.3-1.7 mm wide, semirigid, keeled, brown except basal portion, moderately pilose nearly throughout with the stiff hairs projecting to or somewhat beyond the tip (Figure 2B), brown bract colour finally giving the whole spike a dull greenish to greyish aspect. *Bracteoles* (2.4) 2.8-3.3 (3.8) mm long, 1.4-1.8 mm wide, thin and transparent, usually lustrous except for light brown and acuminate apical region, midvein inconspicuous, few hairs borne in central portion (Figure 2C), never surpassing tip, more or less evanescent with age. *Perianth* rigid, at first strictly erect but later subcampanulate through a curving outwards of exposed firm apices of tepals (primarily of the outer ones), reaching c. 5 mm long, forming with thickened bases of its segments (especially of the inner ones) a turbinate tube about 0.7-0.8 mm long, densely surrounded by a ring of 0.5-1.3 mm long hairlets; dorsal vestiture becoming sparser upwards but masking colour of tepals where not concealed by bracts. *Tepals* linear-lanceolate to narrow-elliptic, broadest above middle, limbate mainly in upper halves, membranous margins usually united towards the appendage-like apex (Figure 2D) and more or less incurved; three veins developed outside as bold ribs, midvein forming a 1.7-2 mm long faint keel above the tube, marginal ones bordering a coriaceous area, convergent higher up. Tepals not uniformly coloured: broad median area tinged purple fading to pink then viridescent, neighbouring scarious tissue keeping pink tinge longest then turning whitish, apical portion (of 0.5-0.8 mm) ivory-white throughout. Dorsal pubescence of tepals comprising straight subverticillate-nodose spreading hairs up to 1.7 mm long, indumentum covering the surface except the apex. *Outer tepals* (Figure 2D) 4.2-4.6 (4.9) mm long and up to 0.8-1.0 (1.1) mm wide when fully grown, involute and more or less abruptly narrowed on one or both sides c. 1 mm below obliquely truncate, dentate to denticulate and/or minutely serrate apex, projecting beyond pubescence and conspicuously bent outward (Figure 2A), completely glabrous within. *Inner tepals* (Figure 2E) narrower, 3.7-4.1 (4.3) mm long and (0.5) 0.6-0.7 mm broad, acute apex bent outward less than in outer tepals, somewhat obscured on outer surface but not exceeded by hairs inserted beneath; internally woolly at about middle, the hairs crisped faintly nodose c. 1 mm long and arising on one or both margins above the tube. *Androecium* and *gynoecium* markedly shorter than perianth. Four *stamens* consistently perfect; free part of *filaments* (0.4) 0.6 (0.7) mm long, c. 0.05 mm wide at middle, subulate above, basally dilated to about 0.2 mm; *staminode* equalling filaments of fertile stamens in length and shape, or somewhat thinner, often with a small appendix to 0.3 mm long or occasionally with a very rudimentary anther. *Filaments* and *staminodes* united with broad sinuses to a membranaceous glabrous tube (Figure 2F, G) to 1.2-1.4 mm long and

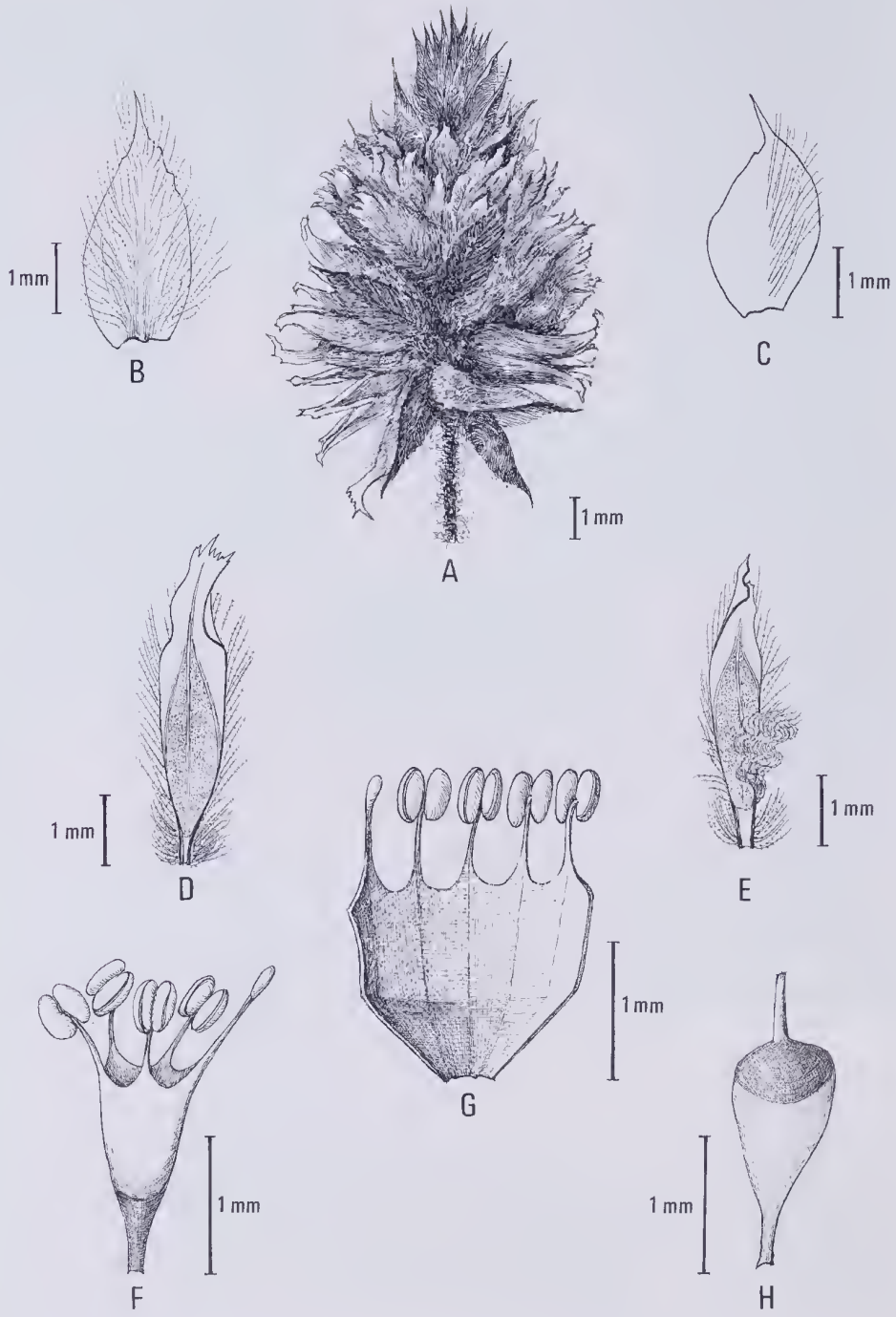

Figure 2. *Ptilotus procumbens* Benl. A—Spike. B—Bract, outer face. C—Bracteole, outer face. D—Outer tepal, inner view. E—Inner tepal, inner view. F—Androecium. G—Staminal tube opened. H—Gynoecium. (Drawn from holotype by A. Böhm).

0.5-0.6 mm in diameter, contracted and intimately adnate to perianth tube in lower 0.6-0.7 mm; *pseudostaminodes* absent. *Anthers* reddish when very young, golden to pale yellow at maturity, broadly elliptic, 0.4-0.45 mm long and 0.3-0.35 mm broad at anthesis. *Pistil* (Figure 2H) entirely glabrous, distinctly stalked when young. *Ovary* turbinate to subclavate, up to 1.6 mm long (including stipe of 0.6-0.7 mm) and 0.7-0.8 mm in diameter. *Style* subcentral, much shorter than ovary and relatively thick, 0.6 mm long by 0.1-0.12 mm diameter widening to 0.15 mm at base; *stigma* completely inconspicuous. Ripe *fruits* and *seeds* unknown.

Distribution. Known only from the type locality where it was collected on a "wash away in deep red clay". Its prostrate habit and unattractive spikes are perhaps reasons for it being overlooked by former collectors in this region.

Discussion. The newly described *Ptilotus* is sharply defined by its prostrate stems in addition to conical spikes, recurved appendage-like tepal tips and a markedly long staminal tube. An association of these characters clearly differentiates the novelty from all other forms and warrants specific recognition.

A staminal tube reaching more than twice the length of the perianth tube has been observed until now only in *P. auriculifolius* (A. Cunn. ex Moq.) F. Muell., Diels' "*Trichinium siphonandrum*". However, this species is an erect perennial with 'ear-shaped' leaves up to 16 x 6 cm. Constantly four perfect stamens also occur in *P. tetrandrus* Benl, but in this species the sterile stamen is aborted to a minute lacinia, furthermore the spikes are interrupted and the stems upright.

No closer affinities to any other *Ptilotus* can be established.

Ptilotus procumbens may be inserted in my key to *Ptilotus* species, in Mitt. Bot. München 9: 135-176 (1971), on p. 155 as follows:

45+ Inner tepals internally woolly 46

46 Bracts haired, brown
a Stems erect, cauline leaves up to 10 x 4 cm. Tepals in lower part with an unusual ridge crested by isolated hairs. Androecium with a minute free ring; ovary villous at top . . . . . .*P. carinatus* Benl
a+ Stems prostrate, cauline leaves up to 3 x 0.6 cm. Tepals without a crested ridge. Androecium with a long staminal tube; gynoecium glabrous. . . . . .*P. procumbens* Benl
46+ Bracts smooth and shining, almost uncoloured etc. *P. leucocoma* (Moq.) F. Muell.

2. **Ptilotus appendiculatus** Benl. var. **minor** Benl, var. nov. (Figure 3)

Differt a varietate typica praecipue habitu ramoso humiliore, inflorescentiis et omnibus partibus florum minoribus.

Typus: Boodardee, about 15 miles (24 km) W of Port Hedland, Western Australia. 9 Sept. 1969, *S. L. Everist* 9195 (holo: BRI 205778).

Diverging from the type variety of *P. appendiculatus* in its much-branched bushy growth and especially in smaller spikes with narrower flowers and less conspicuous appendages of the outer tepals.

Herb or *subshrub* with numerous branched prostrate stems forming close mats on ground surface. More or less bushy plant with a persistent indumentum. *Stem* c. 18 cm long, branches and floriferous branchlets growing sympodially more or less at right angles (thus somewhat resembling *P. obovatus* (Gaudich) F. Muell.). *Spikes* hemispherical or depressed-ovoid to 1.6 x 2.2 cm (hemispherical to elongate-ovoid and up to 4 x 2.6 cm in var. *appendiculatus*). *Bract* 4.2-5.5 mm long, *bracteoles* 5-

Figure 3. *Ptilotus appendiculatus* Benl var. *minor* Benl. Holotype specimen (*S.L. Everist* 9195, BRI). (Photograph K. Liedl).

5.8 mm long (4-7.5 mm and 6.5-8.2 mm respectively in var. *appendiculatus*). *Perianth tube* 0.9-1.3 mm long, (1.6-2.5 mm in var. *appendiculatus*). *Outer tepals* 10-10.9 mm long and 0.6-0.9 mm broad, with rhombic-obovate to -spathulate appendages of 2-2.3 mm long and 0.7-1.2 mm broad (in var. *appendiculatus* 11-13.2 mm long and 1-1.3 mm wide, appendages to 3.2 mm long and 2.5 mm wide; see Muelleria 1: 103, fig. 1, 1959). *Inner tepals* 8.8-10 mm long and 0.4-0.6 mm broad with an apex to 1.5 mm long by 0.8 mm broad (in var. *appendiculatus* 9.8-12.5 mm long and to 0.9 mm wide with a tip up to 1.5 mm long and 1 mm wide). *Stamens* unequal, mostly two adjacent ones fertile. *Filaments* 3.9-4.9 mm long (5-5.2 mm in var. *appendiculatus*). *Ovary* including stipe 3-3.3 mm long, almost entirely glabrous, the eccentric style 3-3.6 mm long (ovary including stipe in var. *appendiculatus* 4 mm long, sparsely pilose at summit, style 4 mm long).

Distribution. Known only from the type locality which is c. 350 km northeast of the most northerly known occurrence of the type variety.

Discussion. There is no reason to assume that the new taxon is merely a dwarf variant of the typical form of the species (up to 1 m across when trailing) grown on a more barren ground: according to the scanty records *P. appendiculatus* var. *appendiculatus* favours "spinifex hills", whereas var. *minor* was collected "in red brown alluvial sand on old flood plain between distributaries of Turner River."

Everist observed the "flowers white to pale ivory coloured". In collections of var. *appendiculatus* dating earlier (e.g. W. H. Butler, 9 Aug. 1963) the pink tinge of the tepals has been preserved up to the present; in more recent gatherings (e.g. R. Pratt 2/0119, 15 Aug. 1979) the collector described the flower colour as "purple, white and yellow". Thus a difference in colour may be an additional point of distinction between the two taxa.

The new plant diverges markedly enough in its habit from the type material of var. *appendiculatus* (Morrison 15098 in BM, E, K) to justify a subspecific rank. However, there are other collections of the typical form (e.g. W. H. Butler s.n., R. Pratt 2/0119), in which the branching resembles that of var. *minor*. Hence a varietal rank for the latter seems to be most appropriate.

3. **Ptilotus astrolasius** F. Muell. var. **luteolus** Benl & H. Eichler, var. nov.

A varietate typica imprimis colore plus minusve uniformi luteolo, floribus manifeste maioribus, bracteis bracteolisque (atro)fuscis, perianthio minus piloso distinguitur.

Typus: 8 miles (13 km) S of Meekatharra on Gabanantha Road, Eremaean Province, Western Australia, 22 Sept. 1957, *N. H. Speck* 884 (holo: CANB; iso: PERTH).

Diverging from the type variety of *P. astrolasius* especially in an almost uniform yellow colour, in having larger flowers, larger dark brown bracts, and a less hairy perianth.

Subshrub with young shoots and foliage densely yellow-villous, the hairs dendroid and up to 0.8 mm long. Fully developed *spikes* 12-17 mm long and 14-15.5 mm broad, conspicuous by glabrous shining apical portions of perianth, contrast between dull dark bracts and protruding lustrous yellow tepals particularly noticeable in a young inflorescence. *Bracts* usually 5 mm long, *bracteoles* up to 6 mm long, some-

times of the same colour. *Outer tepals* becoming 7.8 mm long and 2.5 mm wide; *inner tepals* (woolly bearded inside) averaging 7 mm long and 1.8 mm broad, length of claw very variable; stiff *hairs* from initially purplish claw of bipartite tepals comparatively short, thus leaving major part of tepal limb uncovered, hairs never arising on limb. *Filaments* and *style* to 3.2 mm long.

Other specimen examined. WESTERN AUSTRALIA: 6.4 km N of Mt Alice, Eremaean Province, "Basalt hill", *N. H. Speck* 1185 (CANB, PERTH).

Distribution. Speck's two collections both came from the southern region of the Ashburton Botanical District, Western Australia. These localities are about 400 km from the Hamersley Range, the nearest area known for the type variety. Thus there is no known overlap of ranges of the two varieties.

Discussion. At first glance the geographic separation and the significant differences (especially concerning colour of stems, leaves and bracts, size of floral organs as given in Table 1) between the two infraspecific taxa seem to justify their recognition as two subspecies. However, there is some variation in the colour of perianth and bracts and in the pubescence of tepals among the material of the type form (e.g. Parker 298, in AD, M, MEL, NT; Ashby 4166, in AD), which tend towards the corresponding features of var. *luteolus*. Therefore it seems more appropriate to give the new plant only the rank of varietas.

Table 1. Distinguishing morphological features between *Ptilotus astrolasius* var. *astrolasius* and var. *luteolus*.

Character	var. **astrolasius**	var. **luteolus**
Colour of shoots	Greyish or yellowish turning to light brown	Yellow
Colour of foliage	Hoary to greyish green turning to mid- and pale green	Yellow
Indumentum of young shoots and leaves	Mealy tomentose with a close layer of stellately branched hairs and fewer dendroid ones	Dense villous pubescence of dendroid hairs
Colour of spikes	Greenish- to greyish-white with fading reddish marks	Bicolorous with dark bract and yellow distal parts of the tepals
Bracts and bracteoles	Usually inconspicuous, bracts almost colourless, rarely brownish to deep brown, to 3 mm long; bracteoles to 3.3 mm long	Markedly conspicuous by their dull dark colour; bract to 5 mm long; bracteoles to 6 mm long
Outer tepals	To 4.9 mm long, to 1.6 mm wide	To 7.8 mm long, to 2.5 mm wide
Inner tepals	Mean = 4.2 mm long, 1.1 mm wide	Mean = 7 mm long, 1.8 mm wide
Claw	Somewhat longer than limb	Very variable in length
Length of filaments and style	To 2.3 mm	To 3.2 mm

4. Ptilotus polystachyus (Gaudich) F. Muell., Fragm. Phytogr. Austral. 6: 230 (1868), emend. Benl, Mitt. Bot. München 3: 517 (1960)—Figure 4.

From the very beginning there has been some confusion regarding taxonomy and nomenclature of *P. polystachyus*. Gaudichaud's short diagnosis of *Trichinium polystachyum* from Shark Bay (in Freyc., Voy. Uranie: 445, 1826) did not clearly characterize the species. Mueller's description of *Ptilotus polystachyus* included *T. stirlingii* Lindley and *T. roseum* Moq., both having been described in the meantime (see Bentham, Fl. Austral. 5: 225, 1870). Specimens of *P. stirlingii* at MEL were de-

termined by Mueller as *P. polystachyus*. Therefore, Mueller's concept of *P. polystachyus* had to be "emended" (Benl, l.c.) by excluding *P. roseus* (Moq.) F. Muell. and *P. stirlingii* (Lindley) F. Muell.

In 1838 Lindley (in T. Mitchell, Three Exped. Australia 2: 12) described *Trichinium alopecuroideum* which was separated by Bentham (l.c.: 218) from *T. polystachyum*, the latter being placed by him (l.c.: 225) into the affinity of *T. nobile* Lindley. *Ptilotus alopecuroideus* (Lindley) F. Muell. became the name for one of the most common mainland Australian species of *Ptilotus*, often appearing as a weed along roadsides in Western Australia. However, after comparing the type specimens of *Trichinium polystachyum* (holo: BM; iso: G,P) with the type material of *T. alopecuroideum* (holo: K) I stated in 1960 (Benl, l.c.) that the two taxa must be regarded as identical; thus the long-applied name *Ptilotus alopecuroideus* unfortunately had to be synonymized under *P. polystachyus*.

In 1918 W. V. Fitzgerald (in J. Proc. Roy. Soc. W. Austral. 3: 138) described a new species of *Ptilotus* from the Kimberley, Western Australia, naming it *P. longistachyus*. As there are intermediates between *P. polystachyus* and *P. longistachyus*, especially as regards shape and pubescence of the bracts, size of the bracteoles, development of the staminal cup and length of its hairs, the form of the ovary, insertion and hairiness of the style (Figure 4), *P. longistachyus* had to be reduced to the rank of variety (see Benl, Mitt. Bot. München 2: 403, 1958 and op. cit. 3: 518, 1960). Specimens showing intergradation in some floral details between the two taxa are: 14 miles (22.4 km) NE Dalmore Downs N.T., *G. Chippendale* NT 7340 (M, NT); Maxvale near Charleville Qld., 6 Dec. 1935, *E.H. East* s.n. (BRI); near Broome W.A., July 1911, *E. Mjöberg* s.n. (NSW). Finally *P. polystachyus* var. *longistachyus* (W. V. Fitzg.) Benl cannot be treated any longer as identical with the red-flowered form of var. *polystachyus*, as has been done incorrectly since 1962 (see Benl, Mitt. Bot. München 4: 282). The name is therefore now reinstated.

In 1979 I described *Ptilotus pullenii*. Having now been able to carry out a thorough revision of authentic material of *P. polystachyus* var. *longistachyus* (E, NSW, PERTH) it is clear that with regard to flower morphology *P. pullenii* must be regarded as closely allied to this variety. Therefore, *P. pullenii* is here reduced in rank to a variety of *P. polystachyus*.

Ptilotus polystachyus var. **pullenii** (Benl) Benl stat. et comb. nov. (Basionym *P. pullenii* Benl, Mitt. Bot. München 15: 169, 1979)—see 4f below.

The differences between var. *longistachyus* and var. *pullenii* are not confined to the colour of tepal tips (which are tinged red in the former variety but not in the latter). In addition there are other distinguishing features concerning the diameter of the spikes and especially the shape of their apices, the form, hairiness and midrib of the bracts. These differences are indicated in the key below and are clearly illustrated by a critical comparison of the specimens A. S. George 12813 (var. *longistachyus)* with D. Symon 5271 (var. *pullenii*) cited under 4e and 4f below.

Specimens examined.

4a.**Ptilotus polystachyus** (Gaudich) F. Muell. emend. Benl, var. **polystachyus** f. **polystachyus.**
WESTERN AUSTRALIA: Mt Anderson Stn., S of Fitzroy River, *R. D. Royce* 6916 (PERTH).

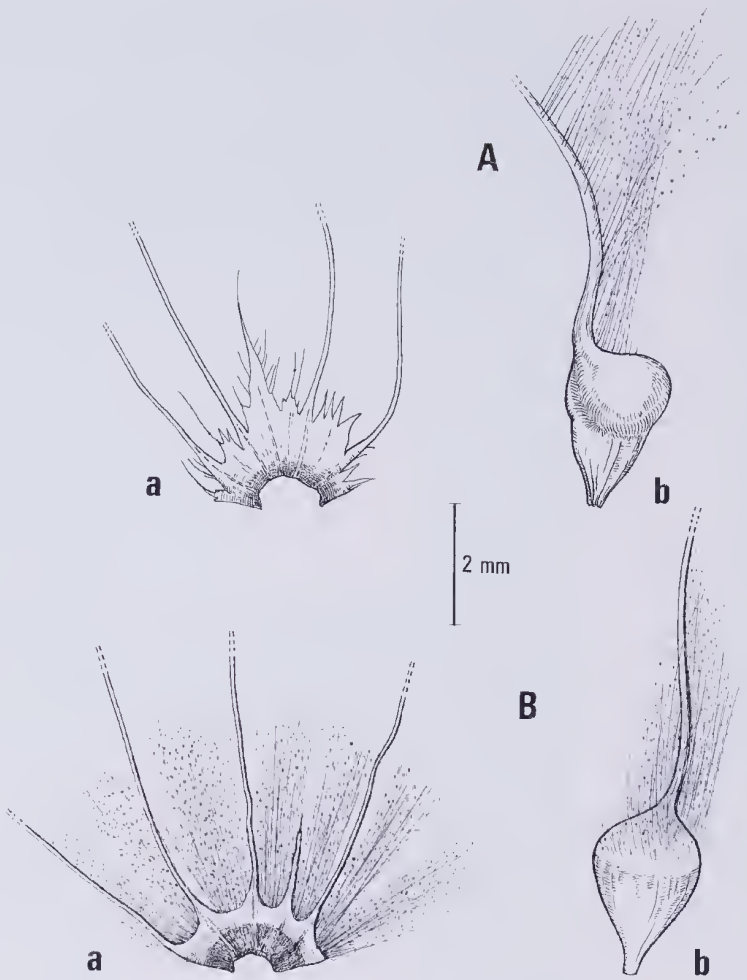

Figure 4. *Ptilotus polystachyus* (Lindley) F. Muell. emend. Benl. A—var. *polystachyus*: a—staminal cup spread open, inner view; b—ovary. B—var. *longistachyus* (W. Fitzg.) Benl: a—staminal cup spread open, inner view; b—ovary. (Drawn from *Hj. Eichler* 18880 (A), *Beauglehole* 54017 (B) by A. Böhm).

NORTHERN TERRITORY: Simpson Desert (24°18′S, 136°37′E), *P. K. Latz* 4613 (AD, CANB, NT).
SOUTH AUSTRALIA: Western edge of Pernatty Lagoon (31°27′S, 137°11′E), *Hj. Eichler* 18880 (AD, CANB, M).

4b. **Ptilotus polystachyus** var. **polystachyus** f. **rubriflorus** (J. M. Black) Benl, Mitt. Bot. München 4: 282 (1962).
NORTHERN TERRITORY: 40 miles (64 km) N of Wauchope Township, *M. Lazarides* 5843 (AD, CANB, M, NT, PERTH).
SOUTH AUSTRALIA: Oodnadatta (27°33′S, 135°27′E), Nov. 1914, *Miss Staer* s.n. (AD).

4c. **Ptilotus polystachyus** var. **arthrotrichus** f. **arthrotrichus** Benl, Mitt. Bot. München 7: 317 (1970).
NORTHERN TERRITORY: c. 80 km towards Borroloola from Daly Waters, *R. Pullen* 9323 (CANB).

4d. **Ptilotus polystachyus** var. **arthrotrichus**. f. **ruber** Benl, Mitt. Bot. München 15: 169 (1979).
WESTERN AUSTRALIA: Anketell Ridge (20°24'S, 122°07'E), *A. S. Mitchell* 1123A (NT, PERTH).

4e. **Ptilotus polystachyus** var. **longistachyus** (W. V. Fitzg.) Benl, Mitt. Bot. München 3: 518 (1960).
WESTERN AUSTRALIA: The Grotto, 2 km W of Great Northern Highway c. 30 km SSE of Wyndham, *A. C. Beauglehole* 54017 (CANB, M, PERTH); Montague Sound, *A. Cunningham* 201 (K); Usborne Harbour, Sept. 1839, *A. Cunningham* s.n. (K); Between Station Creek and Isdell River, *W. V. Fitzgerald* 1080 (E, NSW, PERTH); The Bastian, Wyndham, *C. A. Gardner* 7256 (PERTH); Near Gariyeli Creek, Prince Regent River Reserve, *A. S. George* 12813 (AD, CANB, K, MEL, PERTH); Boomerang Bay, Biggs Is., *N. G. Marchant* 72/25 (M, PERTH); Champagny Is., Bonaparte Archipelago, 27 May 1972, *P. G. Wilson* s.n. (PERTH); Osborne Is. (south west island), Bonaparte Archipelago, *P. G. Wilson* 11146 (PERTH); Cambridge Gulf near Wyndham, 1887, *H. S. Wright* s.n. (MEL).

4f. **Ptilotus polystachyus** var. **pullenii** (Benl) Benl, see above.
WESTERN AUSTRALIA: Dead Horse Springs, near Lake Argyle, *G. W. Carr* 3150 & *A. C. Beauglehole* 46908 (PERTH); Dead Horse Springs, Lake Argyle area, Ord River, *R. Pullen* 10669 (CANB, M, WIR); 3 miles (4.8 km) S of Ord River Crossing (64 miles (102.4 km) N of Halls Creek), *D. Symon* 5271 (ADW, CANB, M, PERTH); Kimberlite Pipe Gap, at head of Smoke Creek, SW of Lake Argyle, *A. S. Weston* 12314 (CANB, PERTH).
NORTHERN TERRITORY: Lat 12°40'S, Long. 133°15'E, *L. A. Craven* 2476 (BRI, CANB, M).

Key to taxa of the Ptilotus polystachyus complex

The situation regarding the *P. polystachyus* complex may be summarized in the following key:

1a. Staminal cup oblique, cleft, ciliate with few short hairs (Figure 4Aa); ovary subcompressed, gibbous (Figure 4Ab), hairs restricted to base of style which is provided in lower half with unilateral hairs to c. 4 mm long. Spike 1-4 cm in diameter; bracts soon glabrous, bracteoles to 6 x 4 mm. Leaves linear or lanceolate 2
b. Staminal cup low, (sub)symmetrical, with copious silky hairlets (Figure 4Ba) to 3 mm long, sometimes enveloping the ovoid ovary like a veil and joining with its pubescence which mainly arises from upper portion of the ovary (Figure 4Bb); bracts hirsute. Leaves (elongate-) spathulate. In Western Australia found north of 18° lat. only 3
2a. Stems and foliage sprinkled with crisped hairs, at length glabrescent var. *polystachyus*
(a) Fully developed spikes greenish turning brownish . . . . . 4a. f. *polystachyus*
(b) Fully developed spikes dull purple fading to brownish . . . . 4b. f. *rubriflorus*

b. Stems and foliage remaining completely tomentose-pubescent. Recorded from Western Australia between 17° and 22° lat. . . . . var. *arthrotrichus*
(a) Fully developed spikes greenish turning brownish . . . . . 4c. f. *arthrotrichus*
(b) Fully developed spikes red fading to brownish . . . . . 4d. f. *ruber*

3a. Spikes 1.6-2.3 cm across, with obviously narrowed apices unless fully grown; bracts mostly acuminate, with (broad-) dark midrib, bracteoles to 5 x 3.5 mm. Perianth pink tipped, becoming creamy to brown . . . . . 4e. var. *longistachyus*
b. Spikes 2.1-3 cm across, with roundish apices subconical when immature; bracts ovate-acute, usually with narrow rufous midribs, bracteoles to 4.5 x 3.5 mm. Perianth pale green becoming brownish 4f. var. *pullenii*

Note. Undoubtedly var. *arthrotrichus* is more closely related to var. *polystachyus* than are var. *longistachyus* and var. *pullenii*. However, intermediates in floral characters between the latter taxa and the type variety, even within the same collection (e.g. A. C. Beauglehole 54017, R. Pullen 10669), forbid application of different taxonomic ranks.

Acknowledgments

Mr A. Böhm, München, prepared Figures 2 and 4, Mr K. Liedl, München, produced the photographs. Dr Hj. Eichler, Canberra, kindly read through taxa 2 and 3. Mr B. R. Maslin, Perth, and Dr A. Kanis, Canberra, gave useful suggestions to improve the text. Dr J. W. Green, Western Australian Herbarium, and Dr R. W. Johnson, Queensland Herbarium, made available the specimens necessary to the studies. The author wishes to express his deepest thanks to all these gentlemen.

A new species of *Billardiera* (Pittosporaceae) from south-west Western Australia

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Abstract

Bennett, E. M. A new species of *Billardiera* (Pittosporaceae) from south-west Western Australia. Nuytsia 4(3):275-277 (1983). *Billardiera mollis*, a new species allied to *B. villosa* and confined to the Ravensthorpe region is described and illustrated.

Billardiera mollis E. Bennett, sp. nov. (Figure 1)

Frutex effusus humilis. *Folia* alterna, ovato-lanceolata vel ovata, 10-20 x 7-11 mm hirsuta. *Flores* solitarii (raro 2), axillares. *Petala* caerulea, 12-15 x 3-6 mm, apice recurva. *Antherae* albae; filamenta 6-8 (10) mm longa, basi latiora, apicibus antrorsis. *Ovarium* hirsutum, 2.5-3.5 mm longum. *Capsula* longe hirsuta; *semina* 1.5-2 mm longa, atro-brunnea, laevia, nitida.

Typus: North-east slope of the southern ridge of the Ravensthorpe Range, Western Australia, 16 Sept. 1979, *E. M. Bennett* 16979 (holo: PERTH; iso: CANB, K, MEL).

Low, spreading *shrub* to 50 cm tall; *young stems* reddish-brown, white hirsute, becoming grey-brown with age and hairs rubbing off. *Leaves* alternate, ovate to lanceolate-ovate, mucronate, 10-20 x 7-11 mm, both surfaces of young leaves long white hirsute, becoming glabrous with age, hairs semi-persistent along margin and midvein, margins flat, petiole 0.75-1 mm long. *Flowers* solitary (rarely 2), axillary; *flowering peduncles* slender, 15-25 mm long, deep blue with scattered long and short white hairs; *fruiting peduncles* 15-25 mm long, green or greenish-brown, hirsute. *Bracts* at base of peduncle lanceolate-linear, 0.75-1.25 mm, dark-blue covered in long and short white hairs. *Sepals* free, narrow-lanceolate, dark blue, hirsute. *Petals* dark blue or blue with 3 or 4 fine distinct purple lines on outer surface, pale blue or nearly white in throat, 12-15 x 3-6 mm, recurved 3-5 mm from tip. *Anthers* 0.75-1 mm long, white, *filaments* 6-8 (10) mm long, whitish green, dilated at base, tip curved forwards. *Ovary* hirsute, 2.5-3.5 mm long; *style* 1.5-2 mm long, glabrous. *Capsules* covered with long white hairs, 7-14 x 5-7 mm long; *seeds* 1.5-2 mm, dark brown, smooth, shiny.

Other specimens examined. North-east slope of the southern ridge of the Ravensthorpe Range, *E. M. Bennett* 51179 (PERTH); Carlingup Road, Rabbit Proof Fence No. 1, 4.4 km south of this intersection, November 1981, *J. Lewis* s.n. (PERTH).

Distribution. South-west of Western Australia. Occurring in the Ravensthorpe Range from near Mount Desmond south of Kundip. It has also been collected 35 km east of the Range from the vicinity of the Rabbit Proof Fence No. 1.

Figure 1. *Billardiera mollis*. A—Flowers and young fruits (nat. size). B—Leaf (x2). C—Young capsule (x3). D—Mature fruit (x1.5). E—Seed (x10). F—Recurved petal (x3). G—Stamen (x3). H—Stamens all turning the same way (x3). I—Hirsute ovary (x3).

All drawn from *E. M. Bennett* 16979 (the type).

Habitat. Seems to be confined to lateritic soils. Associated vegetation include *Casuarina acutivalvis, Dryandra quercifolia, Hakea obtusa, Acacia* sp. nov., *Beaufortia schaueri, Eucalyptus incrassata, E. tetragona, Melaleuca glaberrima, Leucopogon sprengelioides.*

Flowering and fruiting period. Flowers from August to September. Mature seeds have been collected from late November to mid-December.

Discussion. This species differs from the other *Billardiera* species which have a capsule as the fruit in that it has a pubescent capsule, all the other species have a glabrous capsule. The species it most closely resembles is *B. villosa*, but *B. mollis* differs in its habit, being straggly not compact, the margins of the leaves being flat not recurved, the anthers being white not blue and the ovary and capsule being pubescent not glabrous. The foliage of the new species may be readily confused with *Daviesia mollis* which grows in the vicinity, but not sympatrically.

Conservation status. Using the criteria adopted by Leigh et al. (1981) the new species is placed in the category 2K.

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Eucalyptus petraea sp. nov. and *E. lucasii* (Myrtaceae) : two Western Australian boxes

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Abstract

Carr, D. J. and S. G. M. *Eucalyptus petrae*a sp. nov. and *E. lucasii* (Myrtaceae): two Western Australian boxes. Nuytsia 4(3): 279-292 (1983). A new species, *Eucalyptus petraea*, of the taxonomic group (section Adnataria) which includes the boxes and ironbarks, is described. Its morphology and that of *E. lucasii*, another of that group, is discussed in detail. Both are from the south-west of Western Australia. The new species is highly disjunct in distribution in a narrow latitudinal belt. It occurs around the base of, or on, some of the granite bolders which outcrop in the Eastern Goldfields. The ecological basis of its habitat preference is discussed. *Eucalyptus lucasii* has a more continuous distribution within the Austin Botanical District with a few more easterly outliers. The two species differ in a number of floral, fruit and leaf characters. The cuticular pattern of the adult leaves is characteristic of each species and is species-constant. *Eucalyptus petraea* is characterised by a marked tendency to androdioecism, the possible adaptive value of which is discussed.

Introduction

Until mid-century it was believed that the eucalypts commonly known as boxes and ironbarks (section Adnataria, Pryor and Johnson 1971) were restricted to the Eastern States of Australia (excluding Tasmania) and the tropics and were absent from extra-tropical Western Australia. It is true that Blakely (1934) had included a new species from that area, *E. lucasii*, in his section Porantheroideae, but doubts were expressed, particularly by Gardner, concerning the authenticity of the materials on which the new species was based (Johnston and Marryat 1965). The fact that *E. intertexta* R. T. Baker, now regarded as a box, had been collected by Helms in 1891 in the Cavenagh Range was not taken into account by Gardner (1953) because Blakely had placed it in another section (Paniculatae) of the genus. Specimens collected over the last thirty years have established that *E. lucasii* is a reasonably abundant and authentic species, and that *E. intertexta* occurs elsewhere in W.A. than in the Cavenagh Range. There is also a third species which we propose now to describe.

Eucalyptus petraea D. J. Carr et S. G. M. Carr, sp. nov.

Ad 'boxes' et 'ironbarks' affinis, a qua coniunctione sequente characterorum differt: *operculum* exterius mox ante anthesin abscissum; *cicatrix operculina* sulcum circularem ad orificium fructus faciens; *staminodia* numerosa, filamenta staminum brevia; *medulla* caulis sine glandibus oleosis; *cortex* tenuis, in caule inferiore asper et fibrosus, ex et caule superiore et ramis a taeniis longis exfoliatus.

Typus: Gnarlbine Rock, 31°09′S 120°57′E, Western Australia, 29 Nov. 1980, *D. J. Carr* et *S. G. M. Carr* 2373 (holo: CANB).

A species allied to the 'boxes' and 'ironbarks' but distinguished by the following combination of characters: *outer operculum* abscising shortly before anthesis; *opercular scar* forming an annular groove at the orifice of the fruit; *staminodes*

numerous with long filaments; *stamens* with short filaments; *pith* of stem lacking oil glands; *bark* rough and fibrous but relatively thin on lower trunk, deciduous in long ribbons on the upper trunk and branches.

Lignotuberous tree to 14 m tall or a *mallee* (Figure 2A-D), with a finely-fissured, dark-grey, rough, fibrous *bark* (Figure 2D) which is persistent on the lower trunk to 3-10 m but deciduous in long ribbons from the upper trunk and branches. *Adult leaves* alternate, pendulous, concolorous, coarse-textured, dark-green and glossy when fresh, yellowish when dry, lanceolate, 7-12 cm long, 2-2.5 cm broad. Midrib distinct, lateral veins at an angle of ± 30°, intramarginal vein irregular, distant from the margin, with conspicuous minor venation between it and the margin. *Cuticle* of adult leaves thick, smooth and invariably without ornament on both surfaces (Figure 6 [1-6]) and quite different from that of *E. lucasii* (Figure 6 [7-12]). *Synflorescences* acrotonic, unit inflorescences (3-)7-flowered, the proximal ones in the axils of leaves, the distal ones paniculate. Flowers sometimes functionally male. *Peduncles* 1.3-1.8 cm long, angular in cross-section. *Pedicels* somewhat angular, 3-7 mm long. *Flower buds* with two opercula, the outer of which is shed only a few days before anthesis, leaving a wide, very obvious opercular scar. *Petaline operculum* shorter than broad and much shorter than the hypanthium plus pedicel, usually bluntly conical. *Stamens* very numerous in as many as eight rows; *filaments* very slender, all inflexed in bud, inserted on an annular staminophore which projects beyond the orifice of the flower; *outer stamens* anantherous (Figure 3C), their filaments very long, spreading at anthesis; *fertile stamens* with short, more or less erect filaments; *anthers* basifixed, not versatile, broader than long, dehiscing by pores (Figure 3A, B, D). *Nectary* lining the tube of the flower. *Style* shorter than the stamens but projecting beyond the orifice of the flower. *Ovary* with 4-6 loculi; ovular structures in 4 longitudinal rows on the placenta, ovules situated on the margins of the lower part of the placenta. *Capsule* deeply included in the hypanthium, dehiscing by loss of a stylar stub or a lobed, circumscissile lid, valves of fertile fruits absent or incomplete. (The modes of dehiscence are as described by Brooker 1975, and by Carr and Carr 1980). *Hypanthium* thick-walled, coarsely wrinkled in the dry fruit, orifice not contracted, rim broad, marked by a circular groove in which the opercular scars are situated. *Seeds* hemitropous, dorsiventrally compressed, testa dark brown, surface netted. *Cotyledons* oval. *Seedling leaves* petiolate, relatively thin, early ones ovate, later ones lanceolate, acuminate (Figure 5), the intramarginal vein close to the margin of the leaf, especially near the base of the lamina. *Lignotubers* are formed at the cotyledonary node and nodes of the first 4-5 leaf pairs. *Seedling stem* above the 4th pair of leaves square in cross section and pink. Oil glands conspicuous on stem and petioles but not protuberant. *Intermediate leaves* and leaves on reversion shoots (Figure 5A) broadly ovate, sub-glaucous, intramarginal vein distant from the margin.

Selected specimens examined. 4.1 km N of Karonie on track to Cardunia Rocks, *D. Blaxell* 1746 (FRI); Chiddarcooping Rock, *M. I. H. Brooker* 6486 (FRI); Near Horse Rocks, *Carr & Carr* 1250 (CANB); Woolgangie, 30.8 mi. (49.3 km) from Bullabulling on rock, *Carr & Carr* 1254 (CANB); Boorabbin, on rock to N of road, *Carr & Carr* 1258, 1259 (CANB); Yellowdine Rock, *Carr & Carr* 1263 (CANB); Moorine Rock, *Carr & Carr* 1265 (CANB); Queen Victoria Rock, *Carr & Carr* 2367, 2368, 2369, 2375, 2376 (CANB); Baladjie rock, *Carr & Carr* 2377 (CANB); Yellowdine Rock. *S. G. M. Carr & P. G. Wilson* 4042 (PERTH); 1 mi. (1.6 km) E of Karonie, (as *'E. lucasi'*) *R. D. Royce* 5245, 5247, 5248 (PERTH); 1 mi. (1.6 km) W of Warrachuppin, 25 Aug. 1981, *B. H. Smith* s.n.; Dulyalbin Rock, 10 Oct. 1981, *B. H. Smith,* s.n.

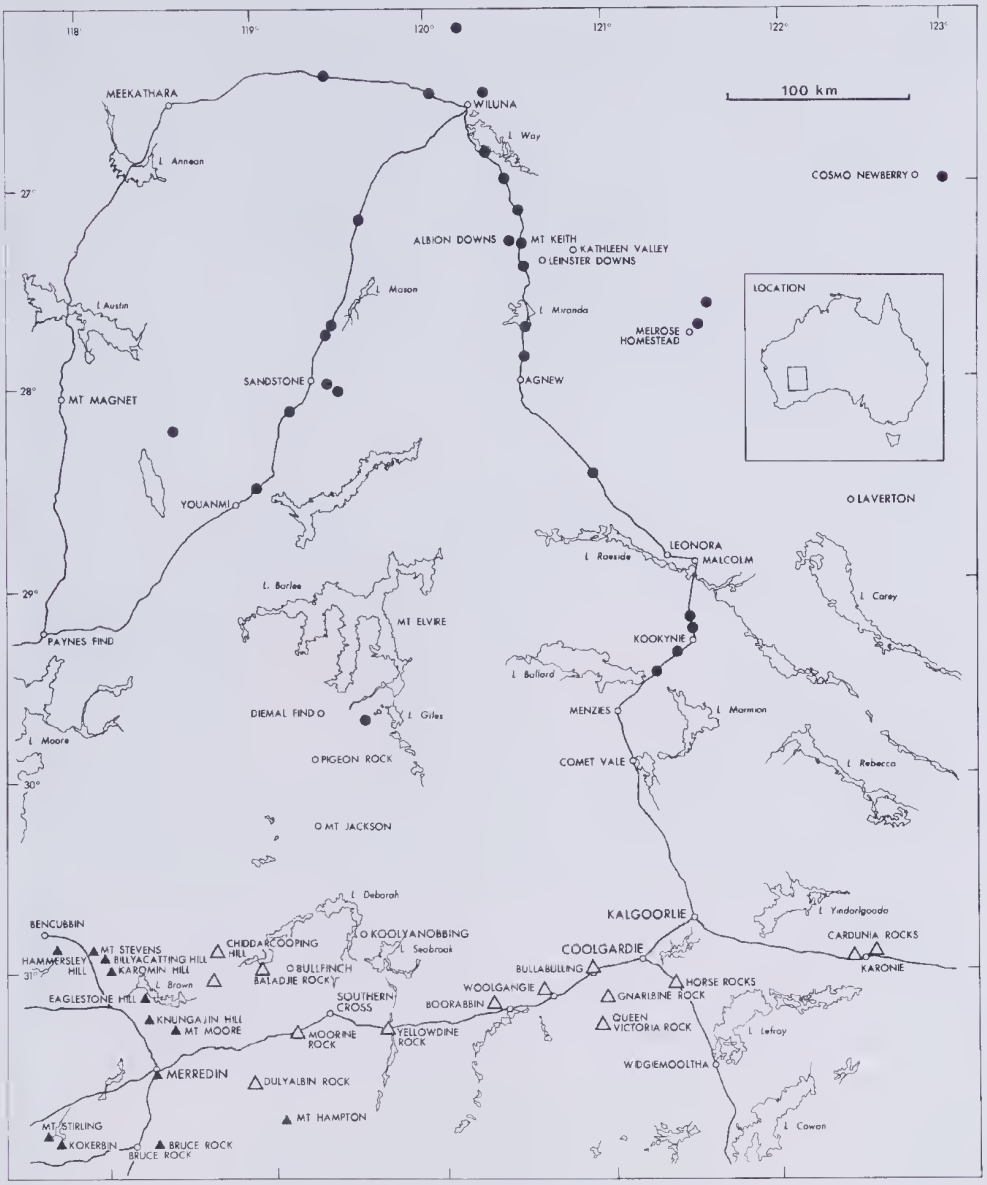

Figure 1. Map of distribution of *E. lucasii* (black circles) and *E. petraea* (large open triangles). Small black triangles represent localities (granite boulders) searched for, but lacking, *E. petraea*.

Distribution and habitat. The species occurs (Figure 1) as isolated populations in the vicinity of granitic boulders or "rocks" in an area bounded by latitudes 30°54′ and 31°17′, and longitudes 118°40′ and 122°32′, i.e. in parts of the wheat belt and transitional woodland, as defined by Erickson et al. (1973). Information on sites of its occurrence and on potential sites where it does not occur, together with additional

information of the same kind provided by Mr and Mrs Basil Smith of Manmanning appears to define all except the eastern boundary of its distribution. It is not known whether the species occurs east of the Karonie district.

A general account of the vegetation of the area in which *E. petraea* occurs has been published by Beard (1969) but he does not deal with the marked zonation of trees or tall mallees at the foot of the granitic 'domes' or boulders. The relatively bare rock surfaces form excellent catchments and the soil around the base of the dome receives a copious flow of rainwater. It is surprising that *E. petraea* was not collected or recognised long ago, for many of its localities (e.g. Moorine) were known a century or more ago to settlers and miners as places at which reliable supplies of water were available, either in gnamma holes or by sinking wells. The now disused but historic well or 'soak' at Gnarlbine is surrounded by tall trees of *E. petraea*. They, or their predecessors, were almost certainly present when the surveyor, H. Maxwell Lefroy, first camped there in 1863 (Harris 1942).

The vegetation peculiar to the granite rocks of South Western Australia has been described by Smith (1962) and by N. G. Marchant, in Erickson et al. (1973: 191-194). Notes with Brooker's Karonie specimen (2458 FRI), refer to its occurrence "in clefts of and near the top of granite rocks". At Yellowdine Rock a large tree of *E. petraea* has colonised such a crevice, but it is an unusual habitat for the species. It is evident from Figure 1 that *E. petraea* is restricted to only a few of the granitic boulders of the area, of which there are perhaps as many as a hundred. The east-west distribution of the sites of its occurrence bears no relationship to the geology of the district or to the size of the boulders. Some very large boulders such as those at Mt Hampton, Mt Stirling, Merredin and Hyden (the latter lying south of the area shown on the map) lack *E. petraea,* while it is present on some relatively small ones as at Horse Rocks, Gnarlbine and Boorabbin. The soils in which *E. petraea* grows are gravelly sands, evidently derived in part, as described in Erickson et al (1973), from exfoliation and ablation of the granite.

We suggest that the conformational relationship of the base of the rock to the surrounding soil is a main determining factor in the present distribution of *E. petraea,* which appears to require a considerable depth of soil at the immediate foot of the rock. At Mt Hampton, for instance, the soil is shallow for some distance away from the foot of the rock, as evidenced by the fact that the well has been dug some 200 m further out. In such shallow soils, trees of *Acacia lasiocalyx* C. Andrews, *Casuarina huegeliana* Miq., *Eucalyptus loxophleba* Benth. and *E. salmonophloia* F. Muell. occupy successive zones at the foot of the rock. Where it occurs in quantity, *E. petraea* displaces *Acacia lasiocalyx*. Similarly, small outcrops of rock, near which the soil is shallow, do not appear to provide suitable sites for *E. petraea.*

The present distribution of *E. petraea* may well have resulted from breakdown of a former wider distribution, as Erickson et al. suggest for other granite boulder species. If the rainfall and consequently the soil moisture storage were higher than at present, it is possible that *E. petraea* could successfully compete for sites away from deep soils at the base of granite rocks. Indeed, at Horse Rocks and at Karonie, the species occurs at some distance from the outcropping rocks themselves; at Horse Rocks, *E. petraea* grows in moist gravelly sand, at Karonie, according to notes with Blaxell's specimen 1746, it is a "locally abundant mallee to 6 m in scrub of this species, *E. kruseana* and *E. brachyphylla* in sandy loam over granite on a low rise".

Figure 2. *E. petraea* (A) At Queen Victoria Rock. (B) At Baladjie, near the base of the rock. (C) The zone of *E. petraea* around the base of the granite boulder at Baladjie. (D) Lignotuber of tree at Queen Victoria Rock. Note also the fibrous, rough bark.

If the breakdown of a more continuous distribution of *E. petraea* had occurred some thousands of years ago, morphological variation from locality to locality ought to be more apparent than it is (cf. Kirkpatrick 1976). The seedlings from different localities, for instance, are remarkably uniform (Figure 4B). In contrast, the inter-locality morphological variation of *E. orbifolia* and *E. caesia* is comparatively large (Hopper et al. 1982). Although the cuticular pattern of *E. petraea* is invariant from locality to locality, variation in stomatal size is not greater than it is in other eucalypts of a more continuous distribution, but on the other hand stomatal frequency varies considerably (unpublished data).

Discussion. The flowers and fruits of *E. petraea* are quite variable in shape, complicating the description of the species. But much of the variation can be understood as a dimorphism based on the fact that many of the flowers are functionally male. Male flowers and indeed male trees of eucalypts have already been described (Carr et al. 1971; Carr & Carr 1972). In *E. petraea* the male flowers are characteristically long, with a long hypanthium tapering into the pedicel; the functionally hermaphrodite flowers are more rounded and club-shaped. Fruits may be set from either type of flower; fruits from male flowers contain no viable seeds, because the ovules lack or have imperfect embryo sacs. Fruits derived from male flowers may remain closed, the valves not separating sufficiently to allow the contents of the loculi to be released. The percentage of male flowers varies from site to site and between individual trees, but probably not from season to season. The single tree of *E. petraea* at Yellowdine has been sampled on several occasions by different collectors over a period of at least 3.5 years, but in none of the collections do the fruits contain viable seeds and examination of a large sample of the flowers reveals them to be all functionally male. It would be desirable to extend the examination to individual trees at other sites and over a long period of years. The single male tree, perched high on the boulder at Yellowdine, may be the only survivor of a population exterminated for firewood or for mining timbers. The only collection from Chiddarcooping Rock (Brooker 6486) has no fruits and only male flowers. Such a marked tendency towards androdioecism may have its explanation in terms of as yet unknown or even now extinct pollinators. It seems unlikely that pollen from the tree at Yellowdine could reach the nearest hermaphroditic flowers at Boorabbin or Moorine Rock, over 80 km away, unless carried by wide-ranging pollinators such as lorikeets (Cleland 1969; Churchill and Christensen 1970). The paniculate masses of white flowers of *E. petraea* would be readily visible to dusk- and night-flying moths, which Main (1981) suggests as possible pollinators of the white-flowered forms of otherwise red-flowered Myrtaceae of the granite boulders. Accidental survival of only male trees at some localities following breakdown of a former continuous distribution seems a plausible explanation of their present occurrence; it is also likely that long-term survival in some localities may depend on repeated regeneration from the lignotuber and that some of the trees—e.g. that at Yellowdine—may be very old indeed, as is suggested by Marchant in Erickson et al (1973) for other granite boulder species.

The discovery and authentication of E. lucasii.

Eucalyptus lucasii Blakely ("*Lucasi*"), Key to the eucalypts, pp. 226-227 (1934). *Type*: Lake Barlee, *Fitzgerald Fraser*, per W. C. Grasby, Sept. 1919 (holo: NSW 145672).

Tree to 10 m or mallee. *Bark* smooth, decorticating in short strips, coppery-brown when fresh, turning grey with age; if stocking of rough bark is present at the base, its height is much less than 2 m. Bark and *pith* of stem without oil glands. *Adult leaves* alternate, petiolate ± lanceolate, thin-textured, grey-green or sub-glaucous (and remaining so when dried), 6-14 cm long, 0.8-2.1 cm wide, with conspicuous oil glands between the intramarginal vein and the margin of the leaf. *Intermediate* and *reversion leaves* ovate, petiolate, very glaucous, 4-5 cm x 2-2.7 cm. Early *seedling leaves* petiolate, ovate, later ones spathulate, relatively thick in texture in contrast with adult leaves, opposite or sub-opposite until at least the 9th pair. *Midrib* conspicuous, *intramarginal vein,* distant from the edge of the leaf in seedling (Figure 5[3]), intermediate and adult leaves. *Oil glands* markedly protuberant on the cylindrical seedling stem and petioles. *Synflorescence* acrotonic, forming a short terminal panicle, unit inflorescences 3-7-flowered. *Peduncles* terete. *Buds* clavate, pedicellate, the

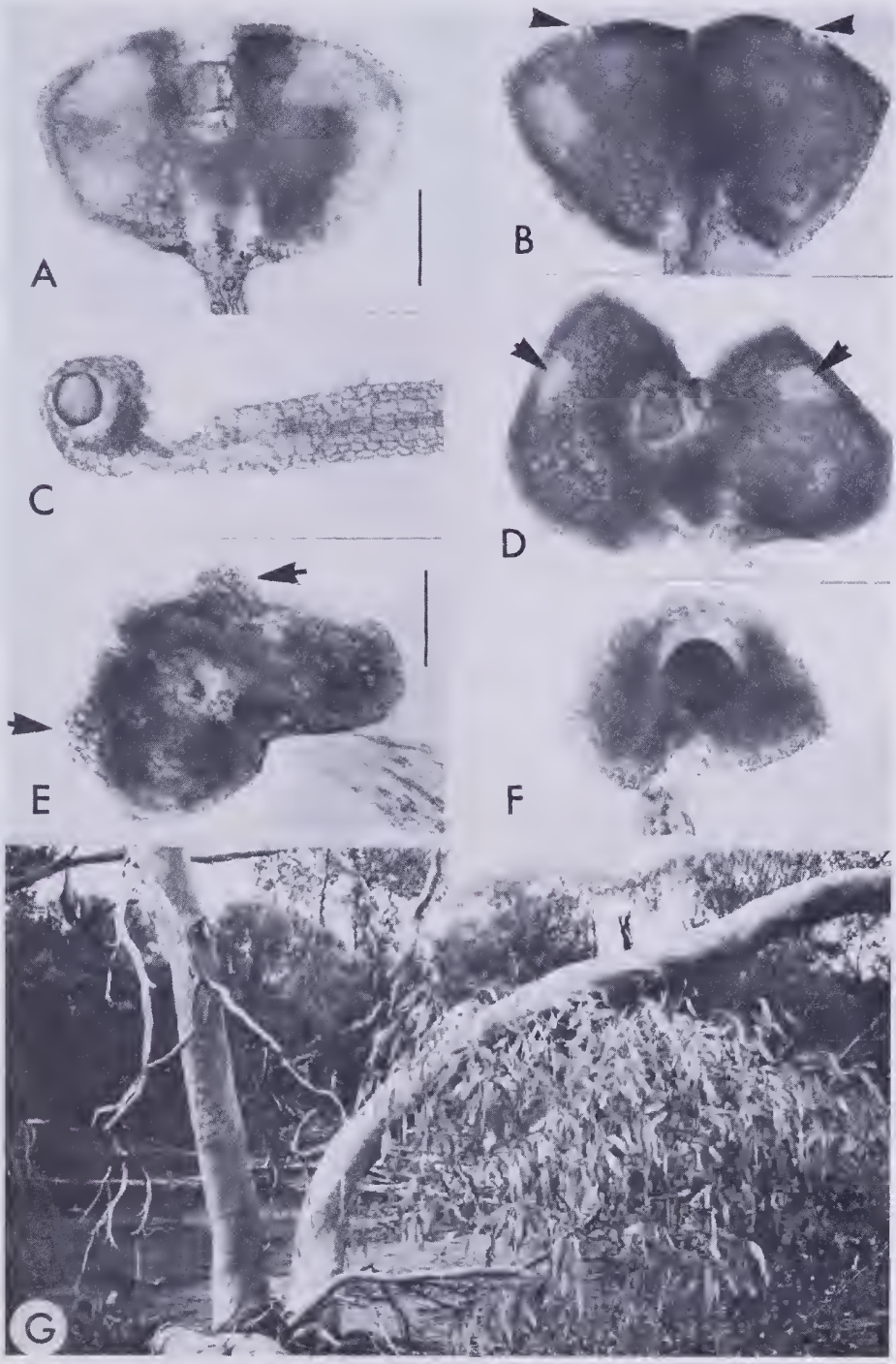

Figure 3. A, B, D, stamens of *E. petraea*, (A) from the back, (B) from the front and (D) seen from above. (C) is a staminode of *E. petraea*. (E) and (F), front and back views of a stamen from the holotype of *E. lucasii*. Arrows in (B) (D) and (E) indicate the pores from which pollen is exuded. Scale bars for A-F, 100 microns. (G) *E. lucasii* as a mallee in a typical habitat, a shallow, flat flood channel.

Figure 4. (A) Branches from *Carr* and *Carr* 2373, the type material of *E. petraea*. Scale, cm. (B) Seedlings of *E. petraea*, raised from seeds from four different localities.

outer operculum early deciduous, its scar inconspicuous at bud maturity. *Filaments of stamens* borne on a narrow staminophore which persists in fruit (but becomes eroded in old fruit). *Outer filaments* long, anantherous; *fertile stamens* with short filaments; *anthers* ovoid, basifixed, adnate to the filament, dehiscence poricidal (Figure 3E). *Fruit* ovoid-truncate tapering to a thin pedicel, less robust than those of *E. petraea. Valves* 4-5, truncate (incomplete), erect, situated well below the orifice.

Other specimens examined. 27 mi. (43.2 km) from Sandstone on Wiluna Rd., *R. Aitken & D. Hutchinson,* HA 26 (PERTH); 7 mi. (11.2 km) N of Melrose Homestead (as '*E. carnei*'), *J. S. Beard* 6533 (FRI); 38.5 km N of Wiluna, *M. Blackwell* 88 (FRI); Opposite Leinster Downs Station turnoff from Agnew to Wiluna Rd., *M. Blackwell* 110 (FRI); Sandstone to Payne's Find, 40 km, *M. I. H. Brooker* s.n. (FRI); 75 mi. (140 km) E of Mt Magnet towards Sandstone, *M. I. H. Brooker* 3689 (FRI); Sandstone to Wiluna Rd., 22.6 km, *Carr & Carr* 492, 493 (CANB); 52.6 km from Leonora on road to Kalgoorlie, *Carr & Carr* 522 (CANB); Batavia Goldmine, Kookynie, *Carr & Carr* 523 (CANB); Sandstone, 4 km *septentrionalem versus,* 27 Aug. 1963, *C. A. Gardner* s.n. (FRI); 40 km N of Sandstone, *in arenosis apertus, C. A. Gardner* 13417 (PERTH); Sandstone 5 km *in lutosis orientalem versus, C. A. Gardner* 13431 (PERTH); 12 mi. (19.2 km) S of Sandstone, 27 Aug. 1963, *C. A. Gardner* s.n. (PERTH); 5 mi. (8 km) N of Laverton, *A. S. George* 8083 (PERTH); Lake Throssel, *A. S. George* 8126 (PERTH); 56 mi. (89.6 km) E of Meekatharra, *E.*

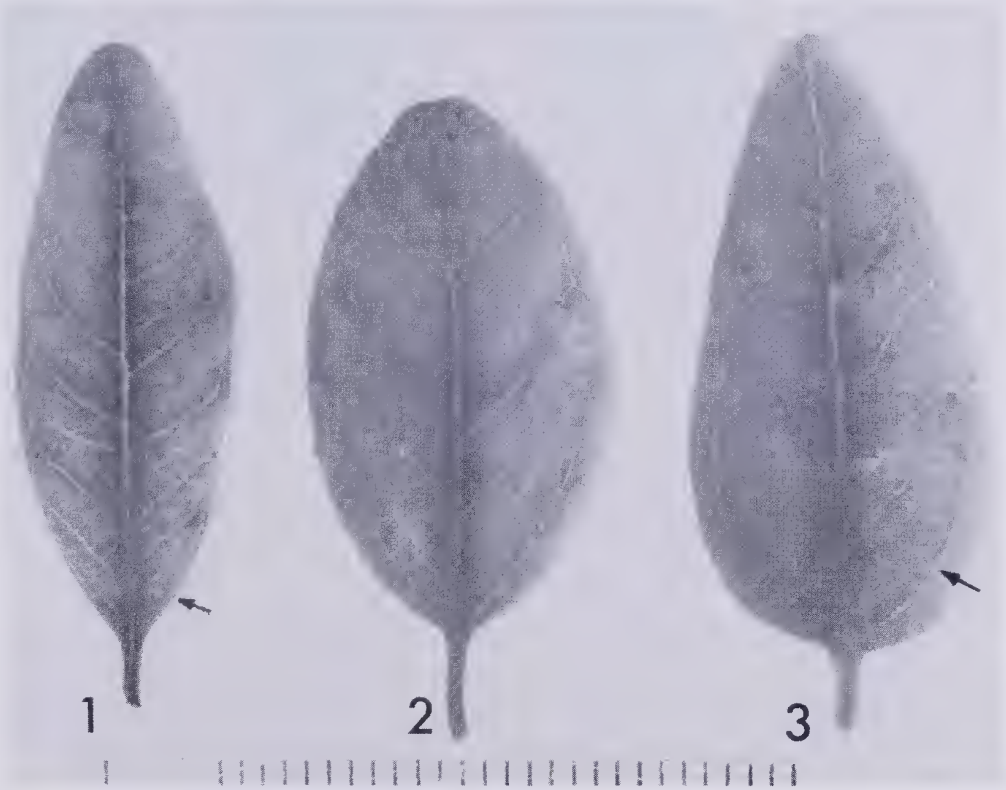

Figure 5. Seedling leaves: (2) an early and (1) a later leaf of *E. petraea.* (3) *E. lucasii.* The arrows indicate the proximity in *E. petraea* of the intramarginal vein to, and, in *E. lucasii,* its remoteness from, the margin of the leaf, especially near the leaf base. Scale markings, mm.

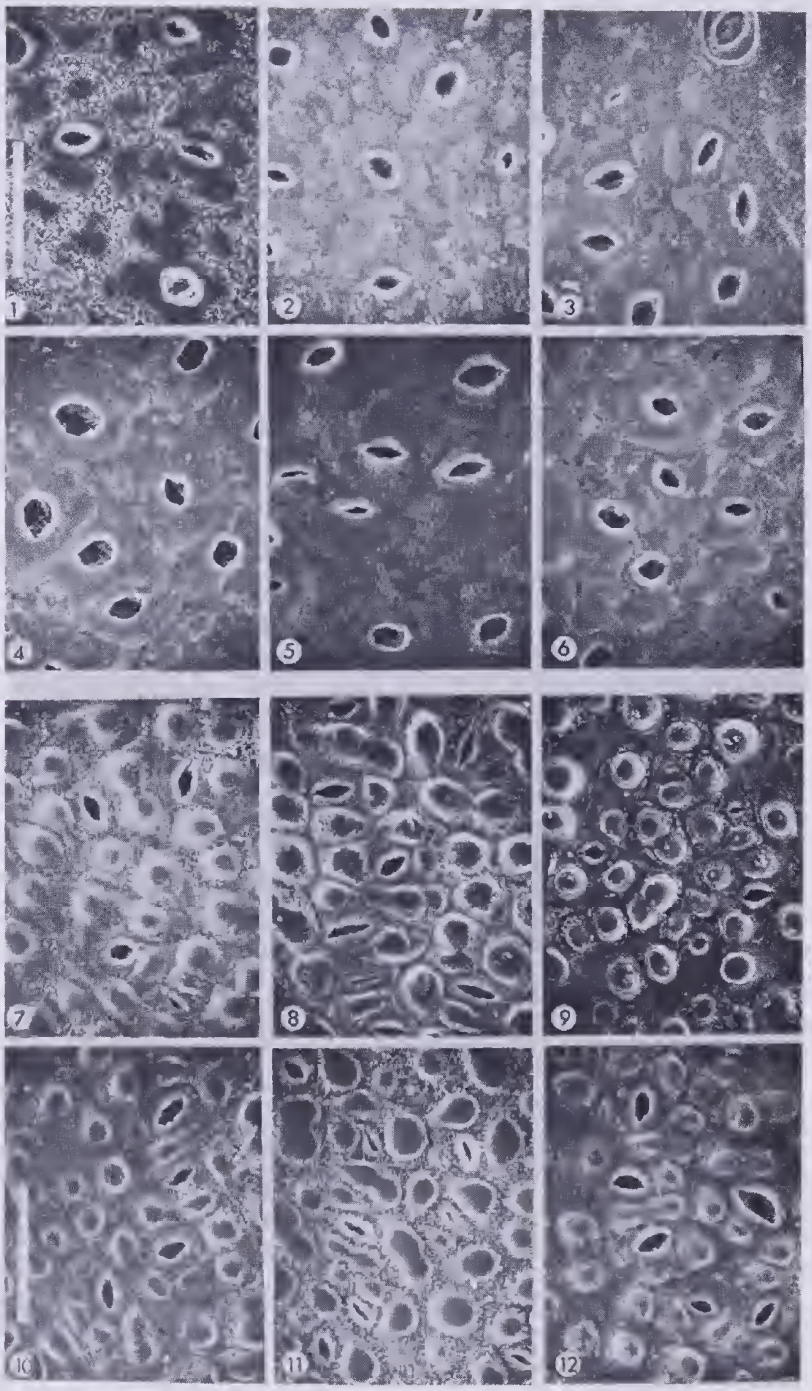

Figure 6. Scanning electron micrographs of adult leaf cuticles of *Carr* and *Carr* specimens of *E. petraea* (1-6) and *E. lucasii* (7-12): scale bar, 100 microns. (1) 1250, (2) 1254, (3) 1258, (4) 1263, (5) 2368 (all lower surfaces), (6) 2375 (upper surface). (7) 492, (8) (493), (9) 494, (10) 522 (all upper surfaces), (11) 523, and (12) 522 (lower surfaces).

Larsen 129 (FRI); 55 mi. (88 km) E of Meekatharra, *E. Larsen* 460 (FRI); c. 6 km E of Cosmo Newberry Mission on Warburton Rd., *B. Lay* 894 (FRI); 17 mi. (27.2 km) E of Payne's Find, *A. R. Main* s.n. (PERTH); 40 mi. (64 km) S of Wiluna, on Sandstone Rd., *N. H. Speck* 12456 (PERTH); 15 mi. (24 km) E of Mooloogool Homestead, Eremaean Province, *N. H. Speck* 1150 (PERTH).

Distribution and habitat. Figure 1 shows the distribution of the species in the Austin Botanical District (Beard 1976), with some specimens from a few more eastern localities. Beard does not mention it in his account of the vegetation of the Barlee Subregion although he does record it in the Wiluna Sub-region. Beard 6533 was determined as '*E. carnei*' so perhaps his references to the occurrences of that species may in part imply *E. lucasii*. The westerly extension of the distribution shown in the maps in Hall and Brooker (1973) and Chippendale and Wolf (1981) is based on two incorrectly determined specimens. *Eucalyptus lucasii* is found in shallow flood channels (Figure 3G) with clayey soils. It also occurs on sand, together with *Triodia* sp., although not on the deep red sands of the District, which, as Beard comments, carry other species of *Eucalyptus*.

Discussion. Eucalyptus lucasii was first collected in September 1919 by Charles Fitzgerald Fraser (1883-1951) near Lake Barlee, not, as in Hall and Brooker, 1973, by W. Catton Grasby. The holotype of *E. lucasii* is accompanied by two rough labels presumably written in the field. The handwriting matches samples of Fitzgerald Fraser's handwriting kindly provided by Mrs Braid, his biographer (Braid 1972). The first label reads "Trees up to 40 ft high and 20-24 in. diameter. Generally distributed over country east of agric'. areas and to Lake Giles. Has black, rough bark up to 5 or 6 ft". The second label reads "Lake Barlee Sep 1919 big tree up to 50 ft. Good mining timber". The information was incorporated more or less verbatim into Blakely's description. Notes on the holotype sheet show that until about 1960, the suspicion was held by C. A. Gardner that the specimen of *E. lucasii* was most likely that of an Eastern States species which had somehow become associated with specimens of *E. loxophleba* Benth., an admixture which evidently took place in the field.

The description given in the protologue "a tree . . . with a rough, persistent bark on trunk for 5-6 feet or more" is incorrect, and derives from Fraser's labels; evidently Fraser was unable to discriminate between *E. loxophleba*, the bark of which fits his description, and *E. lucasii*. Almost all the collections which we have examined have been reported to be of small mallees or trees with the bark smooth to the ground or to within 30 cm of it. Oil glands in the pith of the stem are absent from *E. lucasii* but present in *E. loxophleba*.

All the specimens we have examined have been found to have a uniform pattern of the cuticle of the adult leaves, shown in Figure 6[7-12]. Each epidermal cell has a dome-shaped thickening of its cuticle; occasionally over daughter cells the thickenings coalesce to form a dumb-bell shape. Subsidiary cells of the stomata often have smaller thickenings, the guard cells have none. This cuticular patterning is the same on both surfaces of the leaf; it is constant for the species and of considerable help in identifying specimens lacking mature flowers or fruits. Hall and Brooker (1973) describe the flowers as "in 9-11-flowered umbels" but their illustration (and that of Stan Kelly 1978) shows groups of seven, the most common number. In our material the valves commonly number 4 and sometimes 5, not the "usually 3" of Hall and Brooker (1973).

Figure 7. Representative flowers and fruits of *Carr* and *Carr* specimens of *E. petraea* and one collected by *B. H. Smith* (without flowers; *Carr* and *Carr* 1265 also lacks mature flowers). Scale, cm. The flowers and fruits of 1258 and 1259 are male.

Discussion

Although many early collections of *E. petraea* were designated as '*lucasii*' (e.g. the first collections by Royce in 1956 east of Karonie) or 'aff. *lucasii*', they are not closely related. The two species are readily distinguishable by their bark and leaf characters in the field, and by their leaf cuticular characters (Figure 7 [1-12]), which are invariant in both species, and by flower and fruit characters, in the herbarium.

Acknowledgements

We thank Mr A. S. George for the Latin diagnosis, the Director, Royal Botanic Garden, Sydney, N.S.W. for the loan of the holotype of *E. lucasii*, the Curator of the Western Australian Herbarium (PERTH) for the opportunity to examine specimens, Mr G. M. Chippendale (FRI) for the loan of specimens and for help with specimen label information. We are very grateful to Mrs N. A. Braid for information on Fitzgerald Fraser and for the loan of one of his notebooks and to Mr and Mrs B. A. Smith for searching for and sending us collections of *E. petraea*. We thank Mr R. Jahnke and Mrs Ann Forbes for technical assistance. The work was completed with the aid of a grant from the Australian Research Grants Committee.

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A new species of *Pilostyles* (Rafflesiaceae) from Western Australia

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Abstract

Dell, B. A new species of *Pilostyles* (Rafflesiaceae) from Western Australia. Nuytsia 4(3): 293-294 (1983). A new species of *Pilostyles*, *P. collina* Dell, is described from Western Australia. Its distribution and resemblance to *P. hamiltonii* C. A. Gardner is discussed.

Pilostyles collina Dell, sp. nov.

Alabastra 1.5-2 mm diam. *Flores* aurantiaci et rosei. *Bracteae* 12-15, triseriatae, rufo-aurantiacae, apice ipso brunneolo-aurantiacae, externae suborbiculares vel ovatae, 1.5-2 mm longae et 1.2-1.5 mm latae, internae oblongae vel ovatae, 1-1.5 mm longae et 0.8-1 mm latae. *Segmenta perianthii* 4-5, pallide rosea, oblonga vel angusta obovata, basi abrupte attenuata, 1.2-1.5 mm longa et 0.8 mm lata, apicibus brunneolo-aurantiacis, truncatis vel praemorsis. *Baccae* 2-3 mm diam., polyspermae.

Typus: Middle slope Peak Charles, 32°53′S, 121°10′E, Western Australia. "Endophyte with small pink and orange flowers on *Oxylobium* sp. Host 1-2 m tall in thickets on granite". 10 January 1982, *B. Dell* 8216 (holo: PERTH; iso: CANB, K, G, MO, PERTH).

Vegetative plant entirely embedded in stems of host plant. *Flower buds* 1.5-2 mm diam., globose, solitary, unisexual, fleshy, exserted from bark of host plant. *Bracts* 12-15, reddish-orange, triseriate, imbricate, concave, base broad and fleshy, gradually thinning towards apex, irregularly erosulate along the margin; *apex* brownish-orange, obtuse; *bracts of outer whorl*, suborbicular to ovate, 1.5-2 mm long, 1.2-1.5 mm wide; *bracts of inner whorls* oblong to ovate, 1-1.5 mm long, 0.8-1 mm wide. *Perianth segments* 4-5, pale pink, free, distinct or imbricate, soft and fleshy, shortly attenuate at base, oblong to narrow obovate, 1.2-1.5 mm long, 0.8 mm wide; *apex* brownish-orange, truncate or praemorse. *Disc* epigynous, pink, fleshy when young. *Column* in *male flowers* pink, cylindrical, ± perianth length, apex with a thickened margin and one or two sulci in a shallow depression; *anthers* biseriate, numerous, contiguous under the margin, unilocular. *Column* in *female flowers* very short, expanded at apex bearing ring-shaped *stigma* on its margin; *ovary* lemon-yellow, globose, half inferior, unilocular; *ovules* numerous on parietal placentae. *Fruit* globose, a many seeded berry, 2-3 mm diam.

Selected specimens. WESTERN AUSTRALIA: Foot of Bluff Knoll (34° 22′S, 118° 15′E), *K. F. Kenneally* 6529 (PERTH); Peak Eleanora, 10 Jan. 1980, *J. S. Pate* (PERTH).

Distribution. Western Australia: Known only from Peak Charles and Peak Eleanora (Fitzgerald Peaks), nearby Dog Rock (Pate, pers. comm.) and Bluff Knoll (Stirling Range).

Host. Parastic on *Oxylobium linearifolium* (G. Don) Domin (Peak Charles); *O. atropurpureum* Turcz. and *Gastrolobium velutinum* Lindl. (Bluff Knoll).

Flowering period. January-March.

Pilostyles collina may be readily distinguished from the closely related *P. hamiltonii* by three features. Firstly, the open flowers of *P. hamiltonii* are reddish-purple whereas the open flowers of *P. collina* are a blend of orange and pink. Unlike *P. hamiltonii*, the bracts and perianth segments of *P. collina* have prominent brownish-orange tips. Secondly, the bracts of *P. collina* occur in three whorls and number from 12-15. *Pilostyles hamiltonii* bracts are biseriate and number from 8-12. Thirdly, the open flowers of *P. collina* (1.5-2 mm diam.) are smaller than *P. hamiltonii* (2-3 mm diam.). In addition the two species parasitize different hosts. *Pilostyles collina* has been recorded on *Oxylobium* and *Gastrolobium* whereas *P. hamiltonii* is endophytic in *Daviesia* and *Jacksonia* (Dell 1981). The two species are allopatric with *P. hamiltonii* having the largest geographical range occurring in both the jarrah and wandoo forests (Dunsborough to Kalamunda) and coastal sandplain (Moore River to Eneabba).

On the three host species examined unisexual male and female *P. collina* flowers emerged at random from within the same host stem.

Reference

Dell, B. (1981). Notes on the biology of *Pilostyles* (Rafflesiaceae) in Western Australia. W. Austral. Herb. Res. Notes No. 5: 71-79.

Nuytsia 4(3): 295-315 (1983)

Malleostemon, a new genus of Myrtaceae (subfamily Leptospermoideae, tribe Chamelaucieae) from south-western Australia

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Abstract

Green, J. W. *Malleostemon*, a new genus of Myrtaceae (subfamily Leptospermoideae, tribe Chamelaucieae) from south-western Australia. Nuytsia 4(3): 295-315 (1983). The new genus *Malleostemon* differs from the closely related genera *Thryptomene*, *Micromyrtus* and *Corynanthera* in having geniculate stamens; in addition, some individuals of all species have an eccentric style-base allied with the placenta, while three species may have a several-flowered inflorescence. Two new species are described, *M. minilyaensis* J. W. Green and *M. pedunculatus* J. W. Green, while four new combinations are made, based on names of species formerly included in *Thryptomene* or *Micromyrtus*: *Malleostemon hursthousei* (W. V. Fitzg.) J. W. Green, *M. peltiger* (S. Moore) J. W. Green, *M. roseus* (E. Pritzel) J. W. Green and *M. tuberculatus* (E. Pritzel) J. W. Green. All six species are described, illustrated and their distributions mapped.

Introduction

Malleostemon is based principally on the character of the geniculate stamens, in which the large connective gland is situated at an apparent right angle bend at the top of the filament, so that the anther is borne towards the style. This character was noticed by only one author of a previously-published species (see discussion under *Malleostemon roseus).* Among the genera of the Chamelaucieae it appears to be unique to *Malleostemon* and invariable in it; its occurrence in *Baeckea* and related genera is discussed below. *Malleostemon* shows several other character tendencies which do not occur in *Thryptomene, Micromyrtus* or *Corynanthera;* these are also discussed below.

Study methods and specialised terminology are as explained by Green (1979, 1980a and 1980b).

The term peduncle is used here to refer to the stalk of a solitary flower, as this structure is interpreted as homologous with the peduncle of an inflorescence of 2 or more flowers; both types are common in *Malleostemon.*

The terminology used here for bracts and bracteoles may also need some explanation. Whether they are solitary or form part of a 2 or more-flowered inflorescence, the flowers of *Malleostemon* seem always to be subtended by 2 bracteoles. In addition, an inflorescence of 2 or more flowers is usually subtended by 2 further structures, here called bracts. The bracts are situated at the summit of the peduncle, while bracteoles subtend the flower: these positions are usually indistinguishable in practice, however, as pedicellate flowers are always solitary in *Malleostemon.* The term lectoparatype is used here to refer to a syntype not chosen as a lectotype. A character known for only one or two species is usually omitted from the descriptions of species for which it is unknown. Type citations not on specimen labels are indicated by square brackets. The species are described in alphabetical order.

Malleostemon J. W. Green, gen. nov.

Frutex; folia opposita, decussata; *inflorescentia* 1-3-flora; *sepala* herbacea; *stamina* geniculata, 10 vel 5, antisepala et (vel) antipetala; *ovula* 4-8, placentatio apicalis.

Typus: M. roseus (E. Pritzel) J. W. Green

Shrub, erect. *Leaves* sessile or nearly so, opposite, decussate, entire, gland-dotted. *Inflorescence* of 1-3 flowers in the upper axils, each flower subtended by 2 conduplicate bracteoles; if 2-3 flowered the flowers also collectively subtended by 2 conduplicate bracts. *Conflorescence* if present resembling a terminal or subterminal spike-like raceme. *Flowers* small, not exceeding 7 mm across the open petals; *floral tube* obconical, turbinate, campanulate or urceolate, scarcely produced above the ovary, smooth, rugose or with 5 antesepalous ribs; *sepals* 5, herbaceous, except the scarious margins; *petals* 5, white or pink; *stamens* 10, borne on a narrow staminophore and opposite sepals and petals, the antepetalous ones slightly longer than the antesepalous, or stamens 5, antesepalous or antepetalous, occasionally a few 5-stamened flowers in an otherwise 10-stamened species; *stamens* geniculate or hammer-like, owing to the presence of a conspicuous connective-gland opposed to the introrse anther; *anther* bisporangiate (rarely apparently unisporangiate), bilocular or unilocular (Green 1980a), dehiscing by linear stomia converging above; *style* slender, equalling the stamens, the base often eccentric, owing to the vascular trace bending sharply towards the placenta, which arises from a lateral pocket under the disc, sometimes the style-base and placenta central or nearly so; *ovules* 4-8, radially arranged on a peltate placenta. *Fruit* formed from the scarcely enlarged and hardened floral tube together with the often persistent perianth; *seed* solitary, usually filling the fruit, ellipsoid or reniform; *testa* membranous, pale brown or appearing reddish-brown owing to the adherent tanniferous inner ovary wall; *embryo* having a massive, white, fleshy clavate or cylindrical hypocotyl (sometimes known as a radicle), and a short, slender, curved and sometimes twisted neck bearing two minute linear or semiorbicular cotyledons lying against the hypocotyl.

The new genus belongs to the group of genera in the tribe Chamelaucieae containing *Thryptomene, Micromyrtus* and *Corynanthera* (Bentham 1867, Green 1979). It is distinguished from those genera by geniculate stamens, an eccentric style-base having a common origin to the placenta (found in some flowers of all species) and a tendency towards a 2-3 flowered inflorescence (found commonly in *M. hursthousei* and *M. tuberculatus* and occasionally in *M. roseus*); in addition, the sepals are herbaceous-tipped, a character rare in the above genera, the petals, stamens and sometimes sepals are often pink or pink-tinged, and the placenta is peltate.

Malleostemon has six species restricted to the south-west of Western Australia, occurring between Shark Bay and the eastern goldfields north of Esperance. The plants occur mainly in low shrublands, often with mallee species of *Eucalyptus,* on predominantly sandy or clayey soils.

Etymology. The name combines the Latin *malleus,* a hammer, and the Greek *stemon,* a thread or stamen, referring to the geniculate or hammer-like stamens typical of the genus.

Key to the species

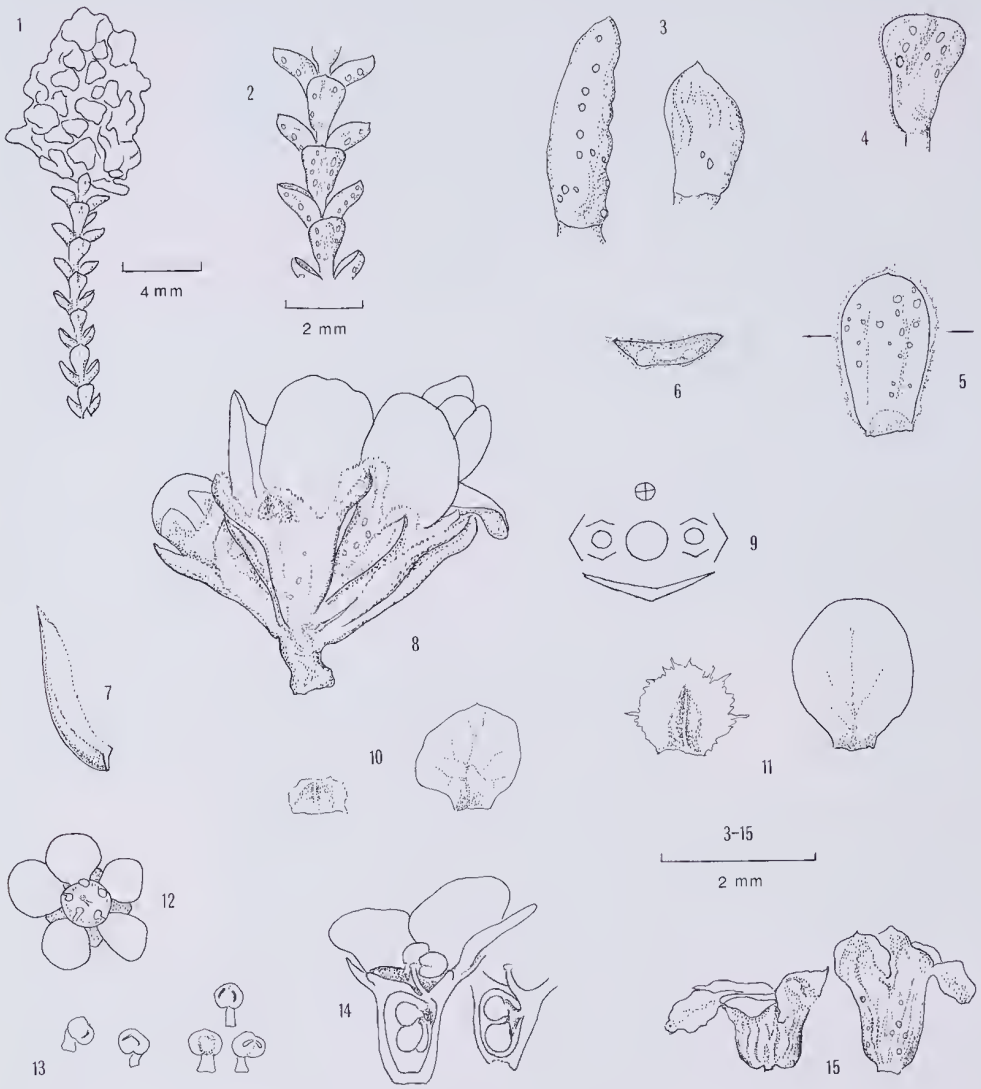
1. Stamens 10
   2. Inflorescence pedunculate
      3. Floral tube campanulate to urceolate; leaves plano-convex, not conduplicate, thick, less than 1 mm wide, oil-glands raised when dry; stamens 5 or 10. . . . . 5. *M. roseus*
      3. Floral tube turbinate to obconic; leaves concavo-convex, more or less conduplicate, mostly 1.5 mm wide, oil-glands immersed; stamens 10. . . . . 3. *M. pedunculatus*
   2. Inflorescence sessile
      4. Leaves peltate, almost spherical, 1 mm thick. . . . . 4. *M. peltiger*
      4. Leaves basifixed, concavo-convex, 0.5 mm thick. . . . 2. *M. minilyaensis*
1. Stamens 5
   5. Leaves 1-3 mm long, plano- or concavo-convex, lacking a terminal mucro; stamens antepetalous; inflorescence 1-several-flowered
      6. Leaves shortly petiolate; stamens above 0.7 mm long; bracts or bracteoles deciduous; flowers solitary or occasionally in triads; stamens 5 or 10
         7. Inflorescence 1-3 flowered, pedunculate; leaves elliptical to oblong, plano-convex; oil-glands raised. . . . . 5. *M. roseus*
         7. Inflorescence 1-flowered, sessile; leaves orbicular, concavo-convex . . . . . 2. *M. minilyaensis*
      6. Leaves broad-based, sessile; stamens below 0.6 mm; bracts or bracteoles prominent, persistent; inflorescence mostly a triad; stamens 5. . . . . 1. *M. hursthousei*
   5. Leaves 3-5 mm long, terete, apex with a recurved mucro; stamens antesepalous; inflorescence mostly a triad . . . . . 6. *M. tuberculatus*

Species descriptions

1. **Malleostemon hursthousei** (W. V. Fitzg.) J. W. Green, comb. nov. (Figures 1-15)

Micromyrtus hursthousei W. V. Fitzg., J. W. Austral. Nat. Hist. Soc. No. 2:22 (1905). *Type*: Murchison district [in sandy soil], October 1902, *E. W. Hursthouse* (holo: NSW7064; iso: PERTH).

Shrub, slender, erect, virgate, 0.5-2 m high. *Leaves* loosely imbricate, ovate, 1.5-2.5 mm long, obtuse, concavo-convex. *Inflorescence* shortly pedunculate, mostly a triad subtended by a pair of persistent, broadly lanceolate, concave, membranous, keeled, lateral bracts up to 2.2 mm long, partly obscuring the flowers within, or rarely the inflorescence 1-flowered, subtended only by a pair of lateral, bract-like bracteoles. *Lateral flowers* of a triad each subtended by 2 bracteoles as long as but narrower than the bracts, disposed radially to the stem. *Flowers* sessile, 3 mm long, 3-4 mm wide. *Floral tube* cylindrical-turbinate, 1-1.5 mm long, obscurely 5-ridged, continuous with the sepal midribs. *Sepals* orbicular, 0.5-1.2 mm diameter, the middle herbaceous and keeled, the membranous border finely and irregularly denticulate. *Petals* elliptic to orbicular, clawed, 2-2.5 mm long, white or sometimes pink-tinged. *Disc* concave, shallow, 1.2 mm diameter, continuous laterally with the short, spreading, free part of the tube. *Stamens* 5, antepetalous, 0.3-0.6 mm long, pale pink; *filaments* 0.2-0.3 mm long. *Ovules* 4, rarely 6. *Fruit* scarcely enlarged, somewhat ridged or irregularly wrinkled; no *seeds* found. *Chromosome number* 2n=c. 44 (*Powell* 74103, Mingenew-Mullewa road, 22 Sep. 1974) (voucher in herb. PERTH).



Figures 1-15. *Malleostemon hursthousei.* 1—Upper flowering branch. 2—Phyllotaxy. 3-5—Leaves, dorsal views. 6—Leaf, TS. 7—Bract. 8—Triad inflorescence. 9—Inflorescence diagram, axis at top, subtending leaf at bottom. 10-11—Sepal (left) and petal (right). 12—Flower from above. 13—Stamens, from bud. 14—Longitudinal half-flower showing ovules. 15—Fruits.

1-2, 10, 11 (right), 12-14 from *Beard* 7332; 3-8 from *Hursthouse,* Murchison (Type); 9, 11 (left) from *Monck,* S of Geraldton; 15 from *Lullfitz* L2947.

Selection of specimens examined. WESTERN AUSTRALIA: 9 miles (14.5 km) N of Murchison River, *A. S. George* 7881 (PERTH); 30 miles (48.3 km) E of Geraldton, *J. Long* 50 (PERTH); 0.3 km along Nangetti road from Mingenew-Mullewa road, *B. L. Powell* 74103 (PERTH); 12.7 miles (20.4 km) S of Coorow, 8 Oct. 1967, *W. A. Loneragan* s.n. (UWA).

Distribution and habitat. This species occurs sporadically in the area from the Murchison River to near Winchester, some 160 km SE of Geraldton (Map 1), mostly in shrublands and scrub heath on yellow or sometimes red sand.

Flowering and fruiting period. Flowering, September-November; fruiting, October-November.

Malleostemon hursthousei is closely related to *M. minilyaensis,* as discussed under that species. The present species is usually easily distinguished by the prominent bracts or bracteoles, which often persist even when flowers and sometimes leaves have fallen, and the typically dense conflorescence of tightly packed triads. Also, the stamens are unusually small for the genus. The character 'ovules 2', given in the protologue, appears to be an error. This species may be a sterile hybrid, as it appears to be a polyploid and is not known to produce seeds. (See also note under *M. roseus* about possible hybridization with that species.)

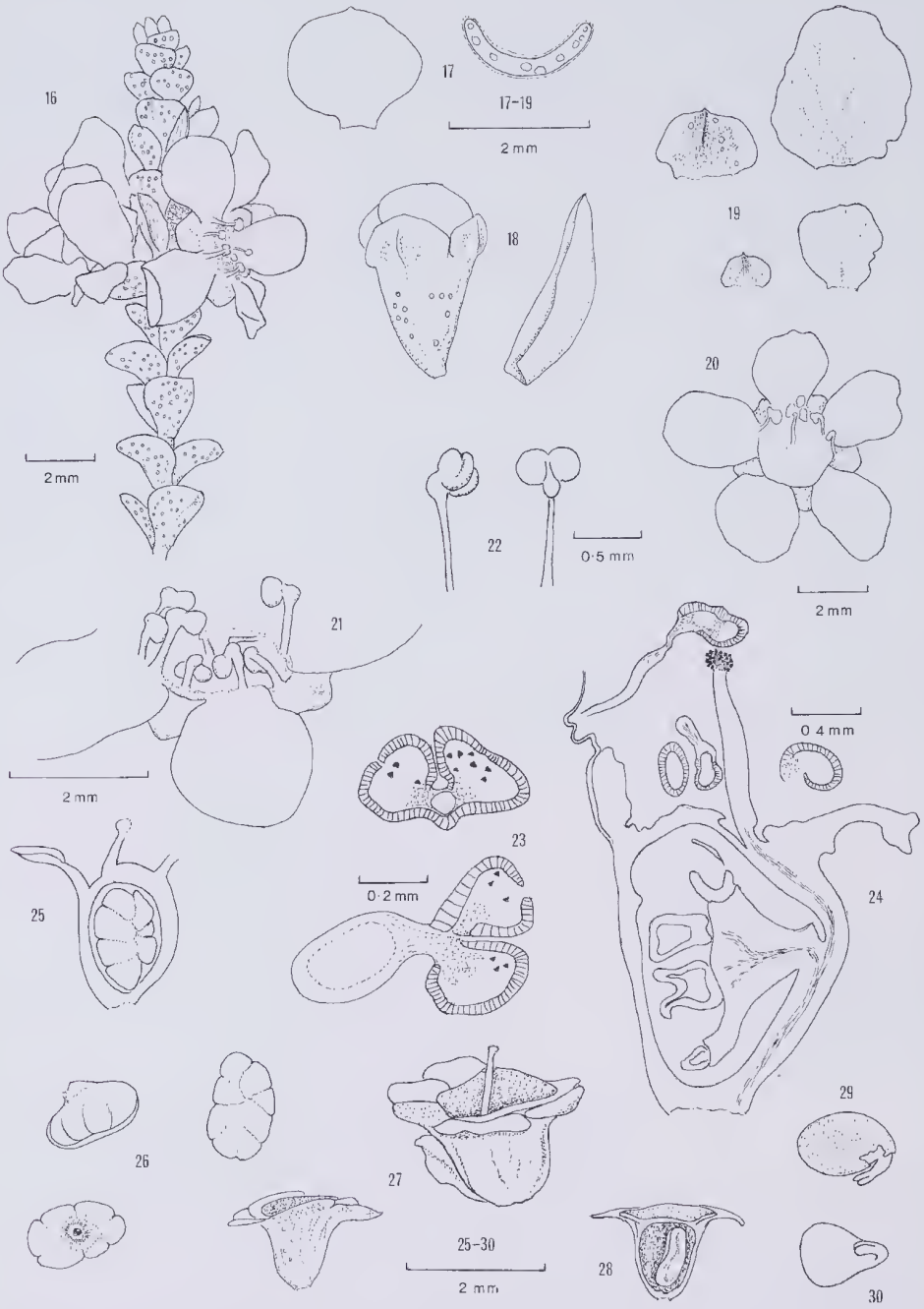
Conservation status. Although not common, it is not thought to be endangered. Of the 15 known collections, one is from a nature reserve.

2. **Malleostemon minilyaensis** J. W. Green, sp. nov. (Figures 16-30)

Frutex; folia orbiculata, supra concava, subtus carinata, basifixa, 1.5-2.5 mm longa; *flores* solitarii, axillares, sessiles; *tubus floris* turbinatus, 5-costatus; *petala* et *sepala* 5; *stamina* 10, antisepala et antipetala; *ovula* 6-8.

Typus: 120.5 km N of Carnarvon, Western Australia, 24 August 1963, *J. S. Beard* 3003 (holo: PERTH; iso: CANB, NSW, PERTH).

Shrub, erect, dense or spreading, 0.5-1.5 m high. *Leaves* crowded, orbicular, 1.5-2.5 mm diameter, apiculate, concave above, keeled below, basifixed. *Inflorescence* a solitary flower in the upper axils; *conflorescence* 8-10 flowered, globular or ellipsoid. *Bracteoles* sharply conduplicate, lanceolate, curved, sometimes undulate, 3 mm long, persistent, the midrib area herbaceous in the upper third. *Flowers* sessile, 3-5 mm long and 9 mm wide. *Floral tube* turbinate, glabrous, 2 mm long, ribs 5, continuous with the sepal midribs. *Sepals* 0.6-1 mm long, broadly elliptic, auriculate, keeled, herbaceous except the narrow, scarious margins or, if largely scarious, having a herbaceous tip. *Petals* orbicular or obovate-oblong, clawed, well-separated at anthesis, 2.5-3 mm long, creamy-white or sometimes tinged pink near the base. *Disc* pale pinkish-brown, flat, 2 mm diameter. *Stamens* 10, 0.7-1.2 mm long, pale pink, occasionally the antesepalous ones lacking; *filaments* 0.5-1 mm long. *Ovules* 6-8. *Fruit* scarcely enlarged, somewhat irregularly ridged or wrinkled, fruiting sepals spreading; *seed* solitary, ellipsoid, 1.5 mm long; *embryo* having a broadly-clavate hypocotyl, twisted neck and minute, linear-oblong cotyledons; *testa* membranous, pale brown.



Figures 16-30. *Malleostemon minilyaensis*. 16—Upper flowering branch. 17—Leaf, in outline (left) and TS (right). 18—Bud (left) and bracteoles (right). 19—Sepal and petal (right), 2 sets. 20—Flower from above. 21—Flower, oblique from above, showing stamens. 22—Stamens. 23—Anther, TS, one through connective gland. 24—Ovary, LS showing eccentric style, placenta and common vasculature, 25—Longitudinal half-flower showing developing ovules. 26—Ovules. 27—Fruits. 28—Longitudinal half-fruit with seed. 29—Seed with emerging cotyledons. 30—Embryo.

16-26 from *Howard* & *Houston* 338-7; 27-30 from *George* 1455.

Selection of specimens examined. WESTERN AUSTRALIA: 16 miles (25.7 km) S of Minilya river, *C. H. Gittins* 1512 (BRI, NSW); 7 km N of Boologooro, *C. A. Howard* & *T. F. Houston* 338-7 (PERTH); Talisker Station, Sep. 1981, *A. Holm* s.n. (PERTH); Yaringa north, *J. Galbraith* 248 (AD, MEL); 436 mile peg (701.5 km) North West Coastal Highway, *A. M. Ashby* 2236 (AD, PERTH); N of Murchison River, *C. A. Gardner* 13313 & 13316 (PERTH); Ajana, 20 Aug. 1963, *A. M. Ashby* s.n. (AD).

Distribution and habitat. This species occurs from the Minilya river, north of Carnarvon, to Ajana, north of Geraldton. Though most collections have been made along the North West Coastal Highway, the occurrence at Talisker, some 100 km east of Hamelin Pool, is suggestive of an inland distribution, largely uncollected owing to the scarcity of roads (Map 1). The only recorded habitat detail is 'sandplain'.

Flowering and fruiting period. Flowering, August (mostly)-September; fruiting, August-September.

Malleostemon minilyaensis is closely related to *M. hursthousei*, which differs in having 5 stamens, 4-6 ovules, obovate-oblong leaves, and smaller flowers. The species are allopatric except for an overlap near Ajana where they nonetheless remain morphologically distinct: *M. minilyaensis* extends northwards almost to the Minilya River, while *M. hursthousei* is distributed southwards to near Winchester.

Conservation status. With only 10 known collections, mostly from agricultural or pastoral areas and none known from National Parks or reserves, this species is possibly endangered.

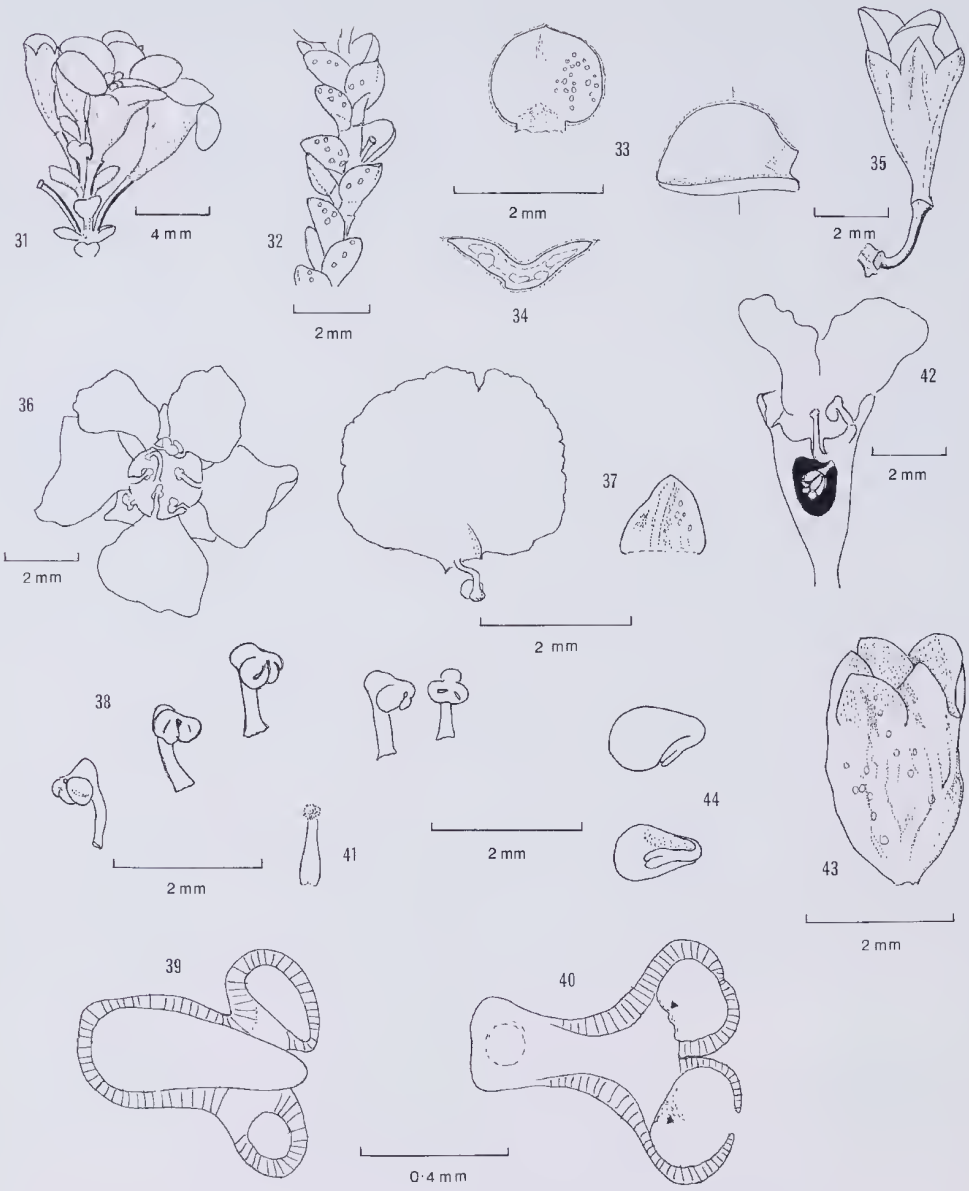
Etymology. The epithet refers to the Minilya River, to the north-east of Carnarvon, where the species approaches the northern limit of its range.

3. **Malleostemon pedunculatus** J. W. Green, sp. nov. (Figures 31-44)

Frutex; folia orbiculata ad obovata, 1-3 mm longa; *flores* solitarii, axillares, pedunculati; *tubus* turbinatus ad obconicus, rugosus; *petala* et *sepala* 5; *stamina* 10, antipetala quam stamina antisepala longiora; *ovula* 4-6.

Typus: 35 km ENE of Tamala homestead, 26 deg. 42 min. S lat. x 113 deg. 43 min. E long., August-September 1980, *C. A. Howard* and *T. F. Houston* 331-5 (holo: PERTH).

Shrub, erect or spreading, 1-1.7 m high. *Leaves* orbicular to obovate, naviculate, 1-2(3) mm long, 0.7-1.2 mm wide, obtuse, sparsely gland-dotted; subsessile or the *petiole* up to 0.4 mm long; *glands* not raised. *Inflorescence* a solitary flower in the upper axils, scarcely conflorescent, often flowering prolifically. *Bracteoles* linear-lanceolate, herbaceous except the narrow, scarious margins, 1.2-1.8 mm long, inconspicuous and early deciduous. *Peduncles* (1)2-3(4) mm long, usually exceeding or at least equalling the leaves. *Flowers* solitary, axillary, often prolific, 2-5 mm long and up to 7 mm across the petals. *Floral tube* 3 mm long, turbinate to obconical, glabrous, rugose or with 5 indistinct longitudinal ridges, opposite the sepals, often green with sparse, golden oil glands. *Sepals* broadly triangular, auriculate, imbricate, keeled, 0.5-0.8 mm long and 1 mm wide. *Petals* orbicular or obovate, narrowing at the base, not clawed but well-separated at anthesis, 2-3 mm long, 2-2.8 mm wide, white, sometimes suf-



Figures 31-44. *Malleostemon pedunculatus*. 31—Upper flowering branch. 32—Phyllotaxy. 33—Leaf, dorsal (left), and oblique (right) views. 34—Leaf, TS. 35—Flower and peduncle. 36—Flower from above. 37—Petal (left) and sepal (right). 38—Stamens. 39—Anther, TS showing gland protruding between loculi. 40—Anther, TS below gland. 41—Style. 42—Longitudinal half-flower showing style, cupular disc and ovules. 43—Fruit. 44—Embryos.

31-42 from *Howard & Houston* 331-5 (Type); 43-44 from *Beard* 7068

fused pink, margins minutely denticulate. *Disc* flat or slightly convex, 1.2 mm diameter, contained within the short free part of the tube. *Stamens* 10, 0.8-1.2 mm long, pale pink, the antepetalous ones longer; *filaments* 0.5-0.8 mm long. *Ovules* 4-6. *Fruit* somewhat swollen, narrow-ovoid, fruiting sepals erect; *seed* solitary, ellipsoid, 1.3 mm long; embryo having a broadly-clavate hypocotyl, twisted neck and minute, linear-oblong cotyledons; *testa* membranous, pale brown.

Selection of specimens examined. WESTERN AUSTRALIA: Shark Bay area, near Useless Loop salt mine, Sep. 1976, *J. Elliot* s.n. (PERTH); Tamala Station, *T. E. H. Aplin* 3519 (PERTH); Between Hamelin and Tamala, *J. S. Beard* 7068 (PERTH); Between Hamelin Pool and Shark Bay, *W. E. Blackall* 4581 (PERTH); Between Hamelin and Nanga, *J. S. Beard* 6765 (NSW, PERTH); 0.5 mile (0.8 km) along a track 8 miles (12.8 km) from Kalbarri, *A. R. Fairall* 1206 (PERTH).

Distribution and habitat. This species is concentrated near the southern shores of Freycinet Estuary, Shark Bay, with an outlying occurrence near Kalbarri; a single collection from 305 mile peg Norseman-Hyden road, (Nelson ANU17342—PERTH) is probably erroneous (Map 2). Label details of associated vegetation include heath and scrub, including *Banksia ashbyi* and 'bowgada' (*Acacia ramulosa*), occurring mainly on sand, sometimes red.

Flowering and fruiting period. Flowering, August-October; fruiting, October.

Malleostemon pedunculatus was first collected in 1940 by W. E. Blackall, who noted 'sp. nov.' on the label. The species is easily recognized by the erect, rather elongated floral tube, tapering into a long peduncle. It has no close relatives in the genus.

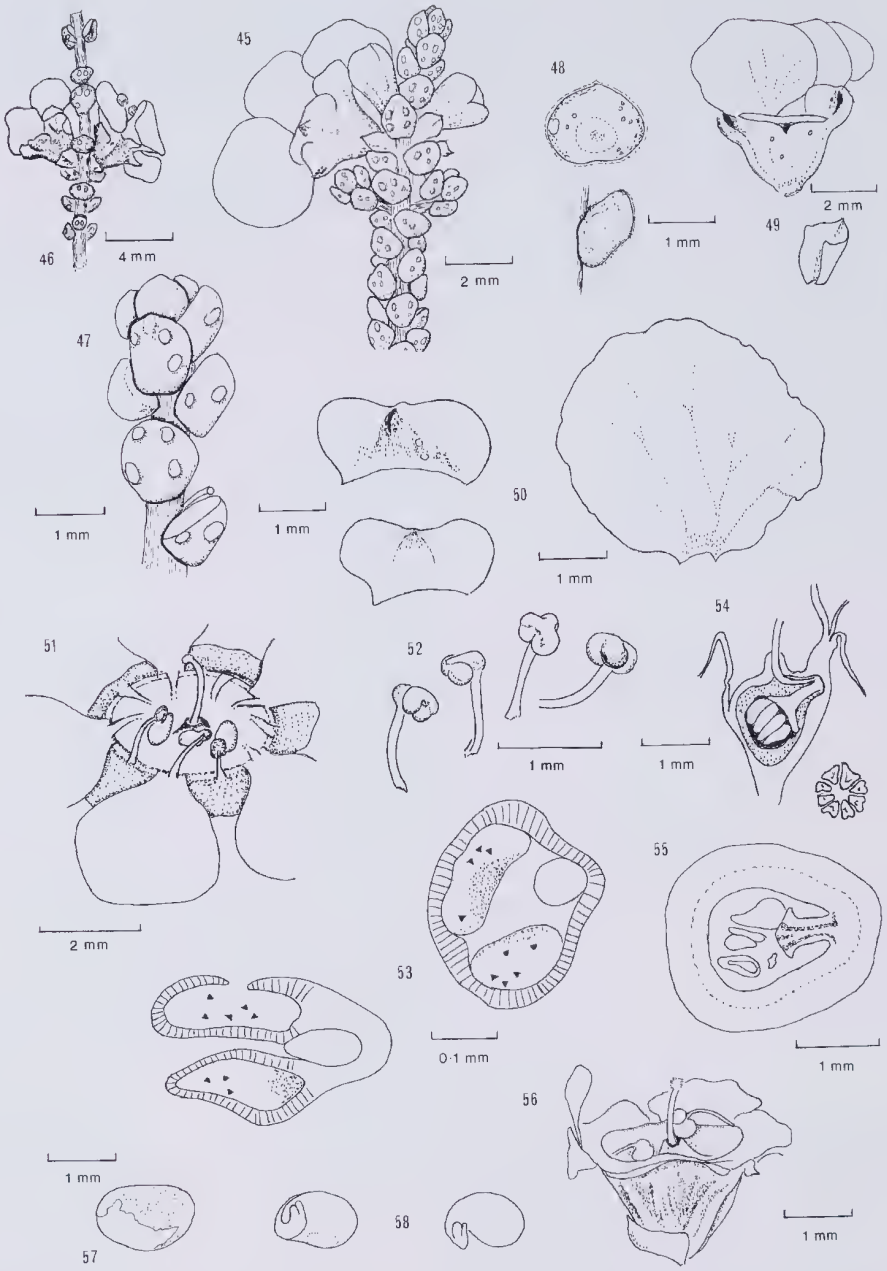
Conservation status. Though known from only 11 collections, this species probably occurs in a National Park and has also been cultivated in South Australia.

Etymology. The epithet refers to the long peduncles which can exceed the leaves.

4. **Malleostemon peltiger** (S. Moore) J. W. Green, comb. nov. (Figures 45-58)

Micromyrtus peltigera S. Moore, J. Linn. Soc. Bot. 45:200 (1920). *Type*: Coolgardie [district], 1899, *L. G.* [*?L. C.*] *Webster* s.n. (holo: BM, presum., not seen; iso: NSW 136165).

Shrub, spreading, straggly, commonly 0.6-1.5 mm rarely 2 m high. *Leaves* imbricate at first, becoming distant, orbicular or nearly so, 1-1.5 mm diameter, thick, peltate, concave above, flattened-carinate below, sometimes almost spherical, drying grey-green, sparsely glandular. *Inflorescence* a solitary flower in the upper axils; *conflorescence* of 1-6 flowers globular, terminal, subterminal or lateral. *Flowers* sessile, 5 mm long, 6-8 mm wide. *Bracteoles* imbricate, broadly obovate, up to 1.5 mm long and 2.4 mm wide, scarious, sometimes pink-tinged, the midrib keeled. *Floral tube* turbinate, 1.2-1.8 mm long, smooth or irregularly ridged, drying dark brown, 5 or 10-ribbed, 5 of the ribs continuous with the sepal midribs. *Sepals* imbricate, subreniform, up to 1 mm long and 2 mm wide, scarious, pink-tinged in one specimen having white petals. *Petals* obovate or elliptic to orbicular, shortly clawed, up to 3 mm diameter, white or rarely pink. *Disc* about 1.2 mm diameter, deep pink, slightly convex or flat, more or less submersed within the free part of the tube, cupular



Figures 45-58. *Malleostemon peltiger*. 45-46—Upper flowering branches. 47—Phyllotaxy. 48—Leaf, ventral view (upper) and vertical section (lower). 49—Flower (upper) and bracteole (lower). 50—Sepals (left) and petal (right). 51—Flower, oblique, from above. 52—Stamens. 53—Stamens, TS through anthers. 54—Longitudinal half-flower, TS ovules. 55—Ovary, TS through placenta. 56—Fruit. 57—Seed. 58—Embryos.

45 from *Wemm* 913B; 46-53, 55 from *Beard* 6735; 54 from *Blackall* 4555; 56-58 from *Lullfitz* L2907.

around the style base. *Stamens* 10, 0.8-1.5 mm long, the antesepalous ones longer; *filaments* 0.7-1.5 mm long, pale pink. *Ovules* 5-8. *Fruit* scarcely enlarged, fruiting sepals spreading; *seed* solitary, ellipsoid, 1.5 mm long; *embryo* having a broadly-clavate hypocotyl, twisted neck and minute, linear-oblong cotyledons; *testa* membranous, pale brown.

Selection of specimens examined. WESTERN AUSTRALIA: E of Nerren Nerren, *J. S. Beard* 7112 (PERTH); 96 km S of Billabong, North West Coastal highway, *G. Perry* 587 (PERTH); 9 miles (14.5 km) N of Murchison river bridge, *R. V. Smith* 66/301 (MEL, PERTH); Near Mullewa, Oct. 1961, *D. H. Perry* s.n. (PERTH); Near Southern Cross, *C. A. Gardner* 1118 (PERTH).

Distribution and habitat. This species has a range similar to that of *M. roseus,* often being recorded from the same localities, but is much less common; moreover its distribution is disjunct between Mullewa and Southern Cross (Map 2). It has been recorded from open heath and scrub containing *Eucalyptus eudesmoides, Actinostrobus, Hakea* and *Acacia,* on yellow or red sand.

Flowering and fruiting period. Flowering, August-November, (mostly October); fruiting, September, November.

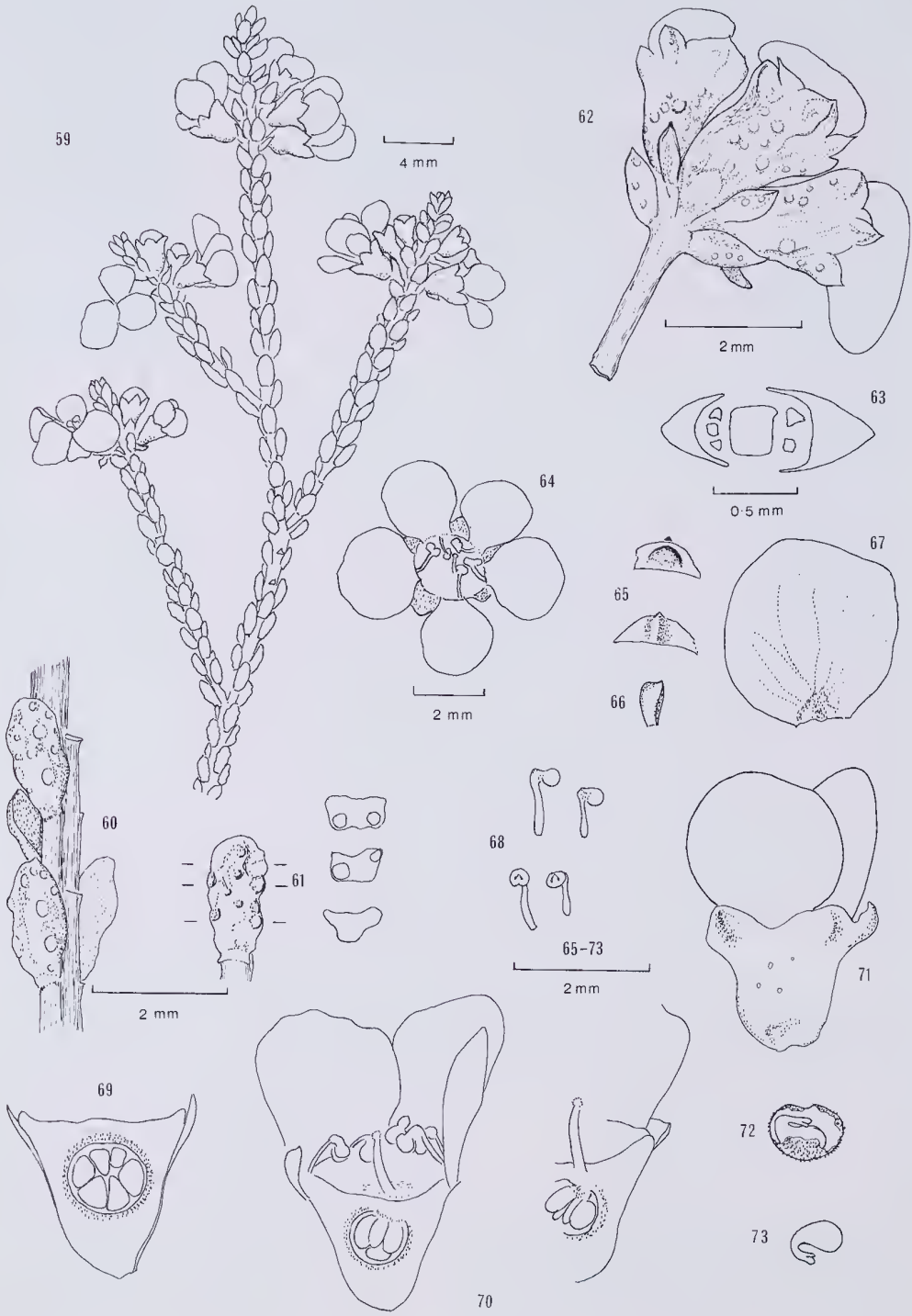
Malleostemon peltiger is closely related to *M. roseus,* being distinguished by the peltate leaves which are unknown in other species of the *Thryptomene* group (see Discussion). Both this character and the relationship to *M. roseus* were noted by the original author (Moore 1920) who nonetheless failed to record the occurrence of the eccentric style-base allied with the placenta, here noted as a generic tendency and most consistently found in this species. Moore also missed the chief diagnostic character of the genus, the geniculate stamens, contenting himself with 'staminibus 10 subglobularis'.

Conservation status. Not endangered, having been collected in one National Park, a nature reserve and a proposed nature reserve.

5. **Malleostemon roseus** (E. Pritzel) J. W. Green, comb. nov. (Figures 59-80)

Thryptomene rosea E. Pritzel in Diels and Pritzel, Bot. Jahrb. Syst. 35: 413-414 (1904). *Lectotype* (here selected): Coolgardie goldfields [pr. Southern Cross in fruticetis arenosis], October 1901, *Pritzel* 862 (NSW loan no. 75/41 383)—*Micromyrtus rosea* (E. Pritzel) S. Moore, J. Linn. Soc. Bot. 45: 200 (1920).

Shrub, erect, virgate, commonly 0.5-1.5 m high and wide or sometimes almost prostrate or up to 3.5 m high. *Leaves* distant, appressed or spreading, typically elliptic to obovate, 1-2.5 mm long, 0.5-1 mm wide, thick, flat to convex above, rounded below, often subglaucous, with several oil-glands protruding somewhat on drying. *Inflorescence* 1-(rarely 2-3)-flowered, in the upper axils; *conflorescence* globular, about 5-flowered. *Peduncle* 0.7-1.5 mm long. *Bracteoles* lanceolate, scarious, carinate, 1.4 mm long, persistent. *Flowers* 3-4.5 mm long, 4-5 mm wide, abundant, often showy. *Floral tube* companulate to cylindrical, smooth or sometimes longitudinally wrinkled, sometimes of a hyaline or parchment-like consistency, up to 2.5 mm long and 2 mm wide. *Sepals* triquetrous, 0.5 mm long, prominently keeled, margins scarious, narrower than the herbaceous centre. *Petals* orbicular, 2 mm diameter, pale to deep pink or sometimes white or pale yellow. *Disc* up to 2 mm diameter, shallowly concave, deep pink. *Stamens* 10, or rarely 5, 0.8-1.6 mm long, the antepetalous


59
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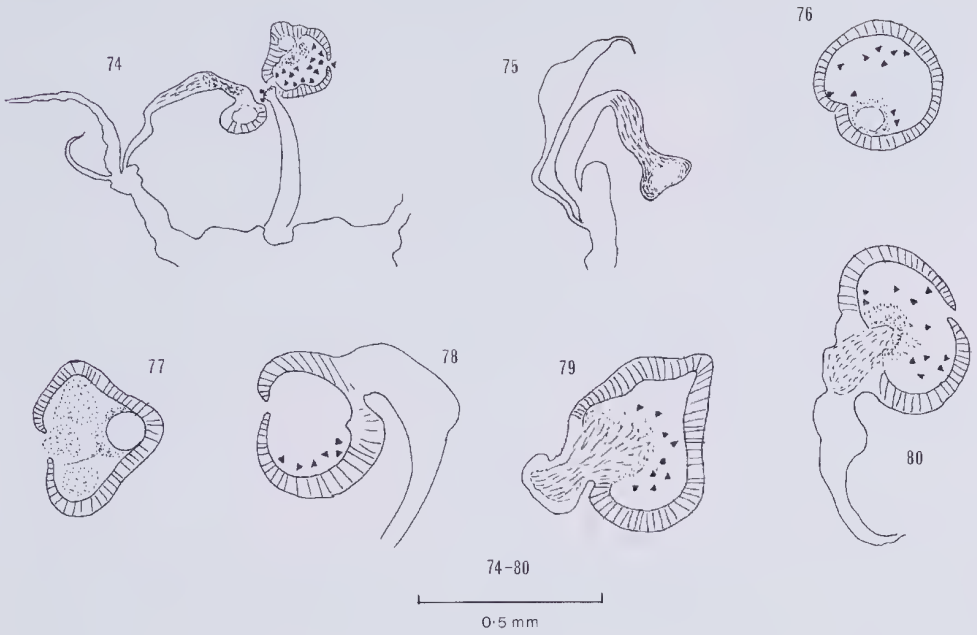


Figures 59-80. *Malleostemon roseus*. 59—Flowering branch. 60—Phyllotaxy. 61—Leaf, dorsal view (left) and TS (3 positions, right). 62—Inflorescence. 63—Floral phyllotaxy. 64—Flower from above. 65—Sepals, ventral (upper) and dorsal (lower) view. 66—Sepal, vertical section. 67—Petal. 68—Stamen. 69—Floral tube cut longitudinally to show ends of ovules. 70—Longitudinal half-flower and part half-flower showing stamens, style, ovary, ovules and tannin cells (dotted). 71—Fruit. 72—Seed. 73—Embryo. 74-80—Stamens, selection of TS and LS showing unilocular, possibly unisporangiate anthers.

59, 67 from *Wilson* 3519; 60-62 from *Shaw* 609; 63, 65-66, 71, 74-80 from *Green* 4638; 64 from *Stacey* 692; 68-70 from *Green* 4658; 72 from *Gardner* 12022; 73 from *A. R. Main*, 61 mi W of Coolgardie, 6 Dec. 1953.

longer; *filaments* 0.6-0.8 mm long. *Ovules* 4-6. *Fruit* somewhat swollen at the base, sometimes hollow beneath the ovary, fruiting perianth erect, stamens sometimes persisting; *seed* solitary, ellipsoid, 1.5 mm long; *embryo* having a broadly-clavate hypocotyl, twisted neck and minute, linear-oblong cotyledons; *testa* covered by a persistent, papillose, red-brown, tanniniferous layer of the inner ovary wall. *Chromosome number* n=11 (*Powell* 76014, cultivated) or n=22 (*Powell* 73014, N of Damboring, 12 Aug. 1973) (vouchers in herb. PERTH).

Selection of specimens examined. WESTERN AUSTRALIA: Butcher's track E of Meadow station, *J. S. Beard* 6832 (NSW, PERTH); 14.5 miles (23.3 km) S of Wannoo, 17 Sep. 1968, *M. E. Phillips* s.n. (CBG, NSW); 64 miles (103 km) N of Murchison River bridge, *D. E. White* 630814 (PERTH); Kirkalocka station 7 miles (11.3 km) E of homestead, *J. S. Beard* 6662 (PERTH); Near Youanmi, 24 Oct. 1963, *C. A. Gardner* s.n. (PERTH); East Yuna reserve, on E boundary, *J. W. Green* 4638 (PERTH); 6 miles (9.7 km) W of Mullewa, *K. Newbey* 2143 (PERTH); 97 miles (156.1 km) SW of Paynes Find, *J. W. Green* 4658 (PERTH); Between Carnamah and Perenjori, *J. S. Beard* 7356 (PERTH); 9 miles (14.5 km) NNW of Ballidu, 13 Sep.

1968, *M. E. Phillips* s.n. (CANB, PERTH); 10 km N of Southern Cross towards Bullfinch, *R. J. Cranfield* 666 (PERTH); Karalee, *L. Diels* 5571 (lectoparatype) (PERTH); 18 km W of Coolgardie towards Southern Cross, *A. E. Orchard* 4189 (AD, PERTH).

Distribution and habitat. This species is common and widespread, occurring from N of the Murchison River to the eastern goldfields, extending inland as far as Youanmi (Map 3). It has been recorded chiefly on sandy and sometimes loamy, clayey or lateritic soils, in heathland and shrubland communities, associated with *Melaleuca, Acacia, Casuarina, Cyanostegia, Pityrodia, Balaustion* and *Verticordia.*

Flowering and fruiting period. Flowering, July-December, mostly August-November with a peak in October; fruiting, December.

Though both syntypes agree with the original description, the large NSW specimen of Pritzel 862 is preferred to the two PERTH fragments of Diels 5571 for the purpose of lectotypification. It is presumed that the holotype in herb. B is destroyed.

Malleostemon roseus is distinguished from the other species of the genus by the smooth, campanulate or urceolate floral tube which dries usually to a smooth, parchment-like consistency, as well as by the flowers which are usually numerous with pink to deep pink petals. The protologue (Diels & Pritzel 1904) contains the first reference to the principal generic character: 'filamentis incurvis apice geniculatis'. The species was also said to be distinguished by the structure of the ovary, though the placentation was described as central, affixed under the style, with no mention of the style-base or placentation being eccentric. Their observation of the relationship of *M. roseus* to *M. tuberculatus* is referred to below, under the latter species. Several specimen labels record white flowers, from sporadic localities including Meadow station, Nerren Nerren station, Cue and Karale, while one collection, from Yorkrakine, is annotated: 'flowers pale yellow'. The red-brown, papillose seed coat is quite different from that of the other species owing to the adherent ovary wall layer. This can be seen to consist in the flower of several layers of thin-walled cells with safranin-positive inclusions which are assumed to be tannin. *Malleostemon roseus* is closely related to *M. peltiger,* which differs from it in the leaves and flowers (see discussion under *M. peltiger).*

A variant from the Murchison River area, having long peduncles, broad leaf bases, leaves with apiculate tips and a glandular-tuberculate floral tube, may possibly represent a hybrid with *M. hursthousei.* It is excluded from the above description.

Conservation status. Not endangered owing to widespread occurrence and inclusion in National Parks and nature reserves.

6. **Malleostemon tuberculatus** (E. Pritzel) J. W. Green, comb. nov. (Figures 81-91)

Thryptomene tuberculata E. Pritzel in Diels & Pritzel, Bot. Jahrb. Syst. 35:411-412 (1904). *Type:* Near Coolgardie [in fruticetis arenosis flor. m. Nov.], 30 October 1901, *Diels* 5231 (holo: B, presum. destroyed; iso: PERTH, 2 fragments).

Shrub, slender, erect, virgate, 1-2 m high. *Leaves* distant, erect, linear, almost terete, to 7 mm long, 0.4-0.6 mm diameter, grooved above, rounded below, acute; mucro terminal, recurved, to 0.8 mm long; *oil glands* several, raised-tuberculate on

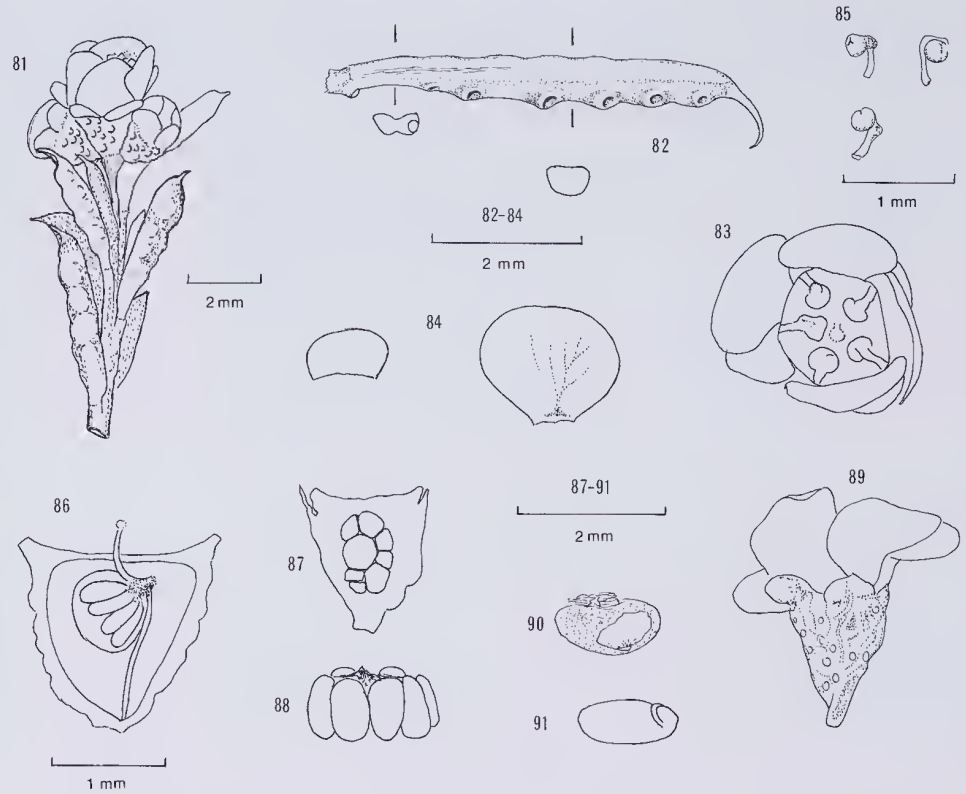
drying. *Inflorescence* solitary in the upper leaf axils, typically a triad, rarely 1-2 or 4-6-flowered, scattered or forming a globular or ovoid conflorescence. *Peduncle* terete or lorate, 2-4 mm long. *Bracts* lanceolate, herbaceous except the scarious margins, 0.8 mm long, often persistent. *Pedicels* mostly absent or up to 0.2 mm long. *Bracteoles* early deciduous, broad-lanceolate, reddish, 0.2-0.5 mm long in the bud. *Flowers* 2.5-3 mm long, 2.5-4 mm wide across the open petals, often profuse. *Floral tube* campanulate to obconical, glabrous, rugose, not regularly 5-ribbed, about 1 mm long, 0.5 mm wide under the sepals. *Sepals* broadly depressed-ovate, imbricate, petaloid or scarious, 0.3-0.5 mm long, 0.8 mm wide, much shorter than the petals, often suffused pink. *Petals* orbicular or elliptic, narrowed at the base though not clawed, well-separated, 1 mm long, pink or white. *Disc* shallowly concave, 1-2 mm diameter, scarcely exceeded by the spreading free part of the tube. *Stamens* 5, antesepalous, 0.7 mm long, pale pink; *filaments* 0.5 mm long. *Ovules* 6-8. *Fruit* scarcely enlarged, irregularly wrinkled, fruiting perianth erect; *seed* solitary, narrow-ellipsoid or almost reniform; *embryo* obloid-cylindrical, neck very short, curved, not twisted sideways, cotyledons almost sessile, semiorbicular, lying flat against the hypocotyl. *Chromosome number* n=c. 22 (*Powell* 74047, S of Payne's Find, 15 Aug. 1974) (voucher in herb. PERTH).

Selection of specimens examined. WESTERN AUSTRALIA: Murchison river crossing, North West Coastal Highway, *D. R. Bellairs* 911 (PERTH); W of Wuraga, *A. M. Ashby* 5180 (AD, PERTH); c. 2.5 miles (4 km) S of Paynes Find, *B. L. Powell* 74047 (PERTH); 80 km SW of Paynes Find, *J. W. Green* 4656 (PERTH); Pindar, *W. E. Blackall* 641 (PERTH); 6 miles (9.7 km) E of Mullewa, 20 Sep. 1968, *M. E. Phillips* s.n. (BRI, CBG, MEL, NSW); Mingenew, *W. D. Campbell* 56 (BRI); 4 miles (6.4 km) S of Tardun, *J. W. Green* 1534 (PERTH); Beanthiny Hill, *C. A. Gardner* 12058 (PERTH); 50 miles (80.5 km) SW of Yalgoo, 13 Oct. 1953, *H. F.* & *M. Broadbent* s.n. (CANB); Pinnacles rocks, 30 miles (48.3 km) S of Jurien Bay, *J. Hart* 15 (PERTH); NE of Mukinbudin, *P. de Rebeira* 36 (PERTH); Mount Churchman, *C. A. Gardner* 13532 (PERTH); Muntadgin, Sep. 1947, *E. T. Bailey* (PERTH); 33 miles (53. 1 km) E of Hyden, *F. Lullfitz* 3827 (PERTH); 13 km N of Southern Cross, *R. J. Cranfield* 663 (PERTH); 70 miles (112.7 km) E of Southern Cross, *W. E. Blackall* 944 (PERTH); Between Callion and Mussons Soak, *J. S. Beard* 6253 (PERTH); Coolgardie, *C. A. Gardner* 830 (PERTH).

Distribution and habitat. This species has a wide distribution from the Murchison River to the eastern goldfields, around Kalgoorlie (Map 4). It is associated with mallee *Eucalyptus,* tall shrublands or scrub containing *Acacia, Grevillea, Eremophila* and *Casuarina,* on soils including yellow sand, laterite, clays and loams, often associated with granite.

Flowering and fruiting period. Flowering, July-November, mostly August-October; fruiting, November.

Malleostemon tuberculatus is the species most consistently displaying the character of a several-flowered inflorescence, noted as a generic tendency absent in *Thryptomene* or *Micromyrtus,* as redefined by the removal of four species to what is now *Malleostemon.* Though maintained until now in *Thryptomene,* on the basis of the antesepalous stamens, the present species might equally well have been placed in *Micromyrtus,* owing to the apical placentation, as noted by the original author (in Diels & Pritzel 1904: 'ovulis 6-8 in placenta laterali orbiculari disciformi affixis') who even pointed out the similarity of the species in this respect to what is now *Malleostemon roseus:* 'forma placenta *T. roseae* similis'. This point was also observed



Figures 81-91. *Malleostemon tuberculatus*. 81—Upper flowering branch. 82—Leaf, lateral view (upper) and TS (2 positions, lower). 83—Flower from above. 84—Sepal (left) and petal (right). 85—Stamens. 86—Longitudinal half-flower showing style, placenta and ovules. 87—Longitudinal half-flower showing developing ovules. 88—Ovules, lateral. 89—Fruit. 90—Seed. 91—Embryo.

81-83, 87-88 from *Green* 4657; 84 from *Scrymgeour* 1535; 85-86 from *Green* 4656; 89-91 from *Ashby* 2029.

by Blackall, who noted on one of his specimen labels (Blackall 641—PERTH): '6 ovules pendulous from summit of ovary'. Fortunately consideration of this problem is now averted by the discovery of the generic character of geniculate stamens which, together with characters of the inflorescence and ovary, places the species firmly in *Malleostemon*. *Malleostemon tuberculatus* is unusual in the shape of the embryo, its curved though untwisted neck, and the shape and disposition of the cotyledons.

Conservation status. Not endangered owing to widespread occurrence including one reserve and in the vicinity of others. Often associated with rocky areas or peaks relatively protected from alienation.

Discussion

When Bentham (1867) published his treatment of the tribe Chamelaucieae, none of the six species here included in *Malleostemon* had been described. Consequently he was not in a position to appreciate the significance of *Malleostemon's* chief diagnostic character, the geniculate stamens, which links what might be termed the

'*Thryptomene* group' (*Thryptomene, Micromyrtus, Corynanthera* and *Malleostemon*) with the '*Baeckea* group' (*Baeckea, Scholtzia* and *Astartea*). According to M. E. Trudgen (pers. comm.), who is presently carrying out revisionary studies in the latter group, the geniculate stamen character forms part of a syndrome, best developed in *Baeckea* sections *Babingtonia* (Lindl.) Benth. and *Harmogia* (Schauer) Benth., where the filaments vary from obviously geniculate to straight.

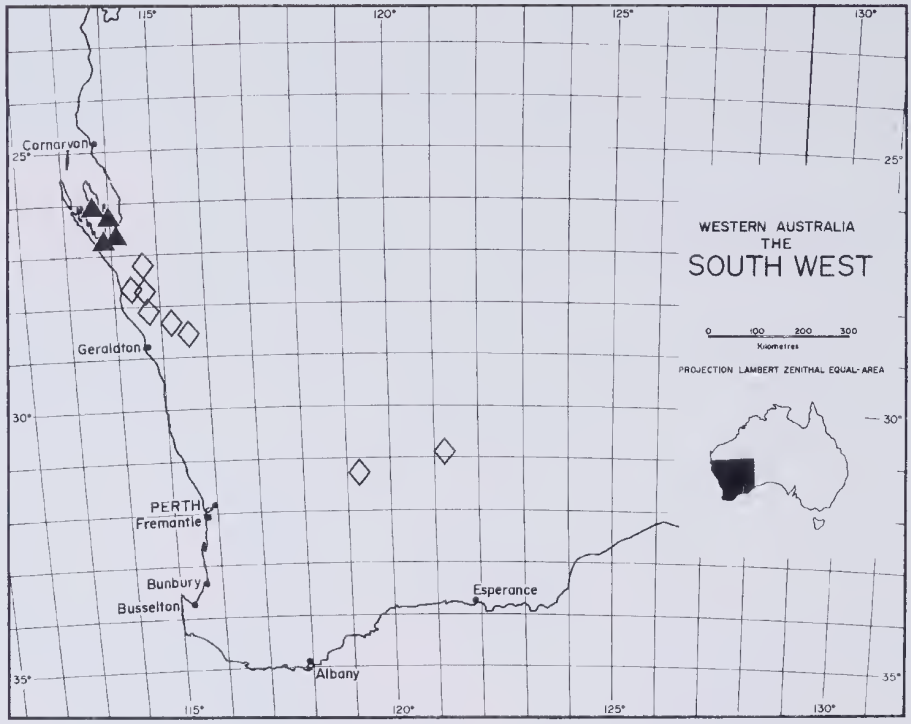
The character of the 'eccentric style base', in which the stylar vascular trace and the placenta have a common origin, is in a sense a consequence of the style being central in the disc and the ovary unilocular. *Malleostemon* seems to differ from other genera of the Chamelaucieae in often having a distinctly leaning style, the base of which clearly leads to a pocket in an upper corner of the ovary cavity (formed at anthesis by the breakdown of the loosely fibrous inner ovary wall) from which the placenta also arises. This arrangement, which is not always evident, but has been seen at least once in each species, may well represent another link between the above groups, being perhaps a stage in the evolution of the unilocular ovary from a multilocular progenitor such as *Baeckea*. This is further supported by the writer's observation (unpub.) in *Thryptomene* and *Micromyrtus* of the rare occurrence of a bilocular ovary in occasional flowers of some specimens—once in a type specimen! Trudgen (loc. cit.) believes that the character of radially-arranged ovules also links the two groups, though this character is of little significance in distinguishing *Malleostemon* from the rest of the *Thryptomene* group. In general, the unilocular character seems reliable enough to justify recognizing the tribe Chamelaucieae (equivalent to the *Chamelaucium* alliance of Briggs & Johnson 1979). Briggs and Johnson have recognized within the *Chamelaucium* alliance two suballiances, the *Baeckea* and *Chamelaucium* suballiances: *Malleostemon* would fall into the second on the basis of its unilocular ovary, yet might be even better placed in an alliance of its own, reflecting its intermediate nature.

The anther description given by Davis (1966) for the Myrtaceae (tetrasporangiate), already requiring modification following the discovery of a trisporangiate anther in *Corynanthera* (Green 1979), now appears to need further revision, for *Malleostemon* seems to have bisporangiate and possibly even unisporangiate anthers.

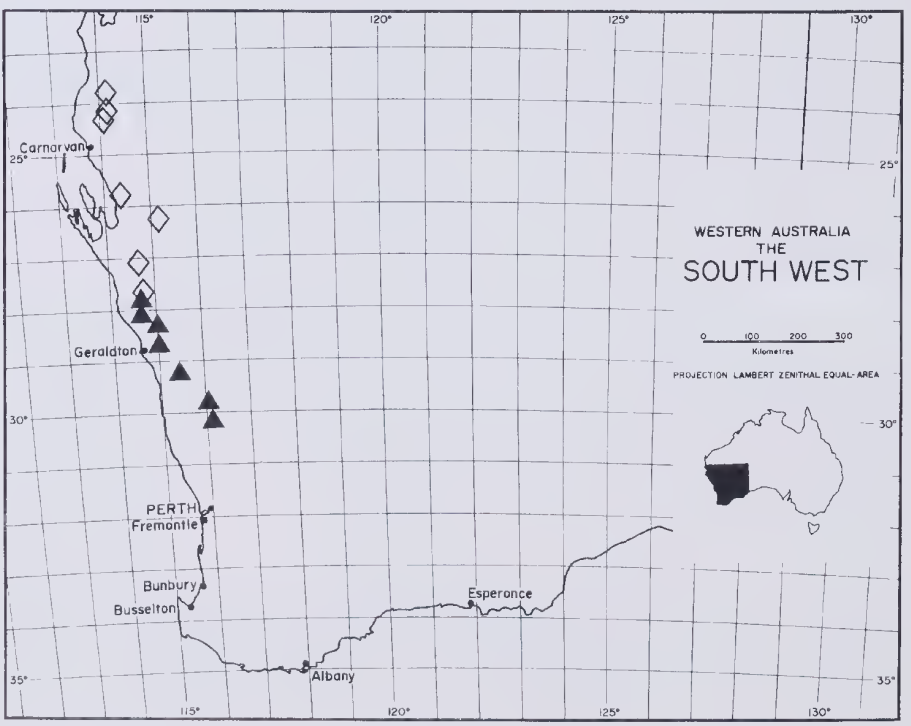
The embryo seems to vary little within *Malleostemon*, its systematic significance being at the subtribal level (Bentham 1867) and above. Embryo morphology seems to provide a further link between the *Thryptomene* group and *Baeckea*, judging by Bentham's (1867) comments on the subtribes of the Chamelaucieae. Landrum's (1981) findings on the relevance of embryos to the classification of the Myrtoideae suggest the possible usefulness of embryo characters in determining a phylogeny for the Leptospermoideae.

In the formal descriptions the term obdiplostemonous has been avoided, because the staminophore is narrow and only a single whorl of stamens is evident on the receptacle. The four 10-stamened species nevertheless have antepetalous stamens exceeding the antesepalous, suggesting that, technically, the flowers may be obdiplostemonous.

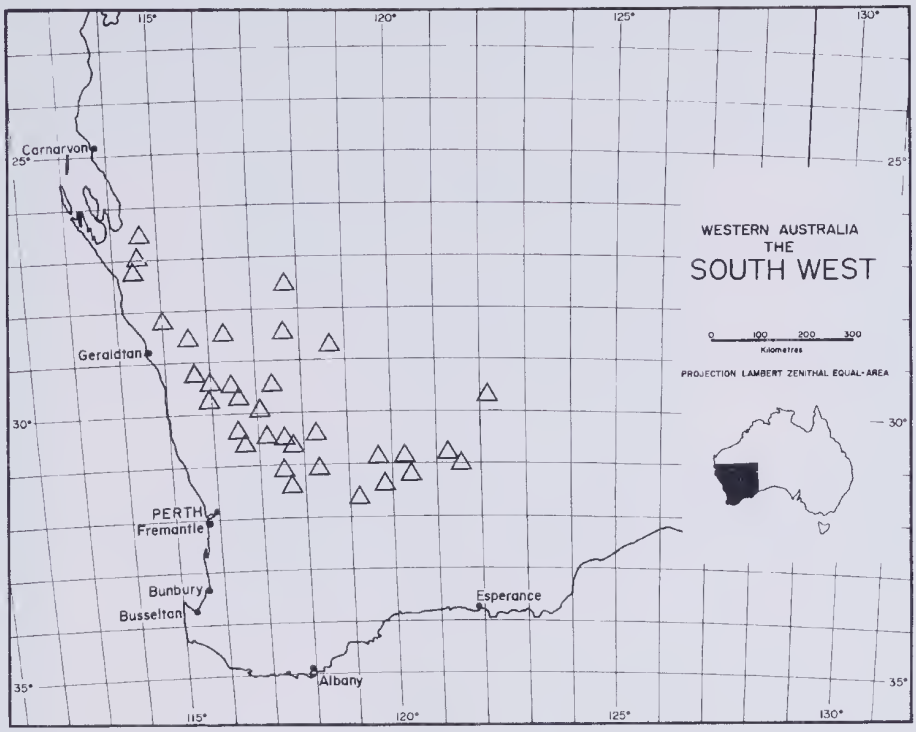
The inflorescence of several species of *Malleostemon* is of interest because of the occurrence of the triad (to use the terminology of Briggs & Johnson 1979), which has not been found in any other species of the *Thryptomene* group. In *Malleostemon*, several-flowered inflorescences other than triads have also been observed, *M. tuberculatus* having up to six flowers in the inflorescence. This may represent



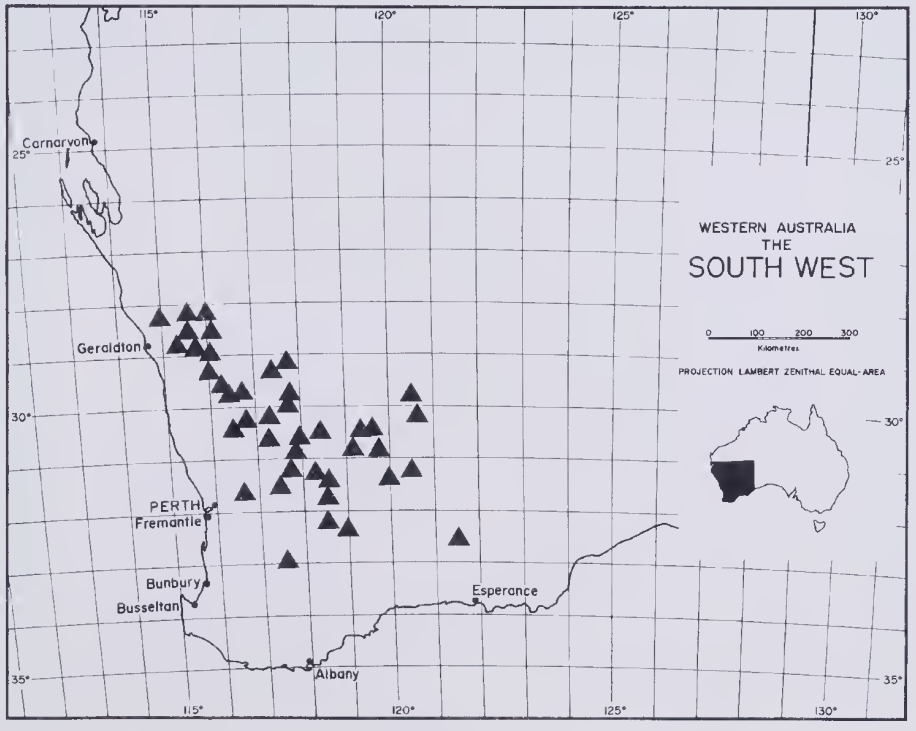
Map 1. Distribution of *Malleostemon hursthousei* (closed triangles) and *M. minilyaensis* (open diamonds).



Map 2. Distribution of *Malleostemon pedunculatus* (closed triangles) and *M. peltiger* (open diamonds).



Map 3. Distribution of *Malleostemon roseus*.



Map 4. Distribution of *Malleostemon tuberculatus*.

another link with *Baeckea*, in which species of section *Babingtonia*, with predominantly solitary flowers, not uncommonly have triads, while one species may have up to 14 flowers per inflorescence (Trudgen loc. cit.).

The limited number of chromosome counts available (Rye 1979) suggests a base of n=11, found in *M. roseus*, and a series of presumed polyploid derivatives: *M. hursthousei* (2n=c. 44), *M. tuberculatus* (n=c. 22) and another population of *M. roseus* (n=22). These data are insufficient to suggest possible evolutionary trends.

A systematic search through herbarium material located only a very few fruits containing seeds, and none at all in *M. hursthousei*. The last point is hardly significant in the circumstances but, taken together with the evidently tetraploid nature of *M. hursthousei,* may be indicative of a hybrid origin of that species.

Several lines of future research are suggested by the present study. These include: anther relationships with genera in other tribes; anatomical investigation of the "eccentric style" character; cyto-evolutionary studies; development of the triad inflorescence; anatomy and development of stamen number and position; significance of tannin in the ovary wall of *Malleostemon roseus;* and significance of embryo morphology in classification.

Acknowledgements

It is a pleasure to acknowledge the assistance of my colleagues who readily discussed problems and provided ideas. In particular I want to thank Mr Paul G. Wilson who also provided essential guidance in nomenclatural matters and wrote the Latin descriptions. All those assisting on the technical side are thanked, particularly Mr R. J. Cranfield for his many hours of patient dissection and slide preparation. Herbarium directors and their staffs are thanked for making large and extended loans of specimens.

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Rye, B. L. (1979). Chromosome number variation in the Myrtaceae and its taxonomic implications. Austral. J. Bot. 27: 547-573.

Index to collections seen

In this Index the collectors' numbers are ordered by the leading digit, eg. 2236, 315, 4947.

Alexander, Waddouring (PERTH) (6); *Anon.*, East Yuna Reserve (PERTH) (4); *Anon.*, nr Southern Cross (PERTH) (5); *Aplin* 3519 (PERTH) (3); *Ashby* 2029 (AD) (6); *Ashby* 2236 (AD, PERTH) (2); *Ashby* 315 (AD) (5); *Ashby* 4947 (AD, PERTH) (5); *Ashby* 5180 (AD, PERTH) (6); *Ashby* 5378 (AD) (5); *Ashby* 5391 (PERTH) (4); *Ashby* 5391A (PERTH) (1); *Ashby* 5395 (AD) (6); *Ashby*, Ajana (AD96428075) (2); *Bailey*, Muntadgin (PERTH) (6); *Barker* 2178 (AD) (4); *Barker*, 20 mi E of Perenjori (PERTH) (5); *Barrett* 5 (PERTH) (6); *Beard* 1983 (PERTH) (1); *Beard* 1993 (PERTH) (4); *Beard* 2617 (PERTH) (6); *Beard* 3003 (PERTH) (2); *Beard* 5141 (PERTH) (6); *Beard* 5146 (PERTH) (5); *Beard* 6195 (NSW, PERTH) (6); *Beard* 6253 (PERTH) (6); *Beard* 6521 (PERTH) (6); *Beard* 6662 (PERTH) (5); *Beard* 6698 (NSW, PERTH) (6); *Beard* 6722, 6735 (NSW, PERTH) (4); *Beard* 6736 (NSW, PERTH) (5); *Beard* 6765 (NSW, PERTH) (3); *Beard* 6832 (NSW, PERTH) (5); *Beard* 7068 (PERTH) (3); *Beard* 7112 (PERTH) (4); *Beard* 7113, 7146, 7356, 7980 (PERTH) (5); *Beard* 7214 (PERTH) (6); *Beard* 7332 (PERTH) (1); *Beard* 7954 (PERTH) (6); *Bellairs* 911 (PERTH) (6); *Bennett* 1481 (PERTH) (4); *Blackall* 3299 (PERTH) (5); *Blackall* 3350, 3500 (PERTH) (5); *Blackall* 3412 (PERTH) (6); *Blackall* 3424A (PERTH) (6); *Blackall* 3785 (PERTH) (6); *Blackall* 3790 (PERTH) (6); *Blackall* 4555 (PERTH) (4); *Blackall* 4581 (PERTH) (3); *Blackall* 4724 (PERTH) (4); *Blackall* 641 (PERTH) (6); *Blackall* 720 admixture (PERTH) (6); *Blackall* 944 (PERTH) (6); *Blackall*, nr Narembeen (PERTH) (6); *Blackall*, nr Southern Cross (PERTH) (5); *Blockley* 1010 (PERTH) (5); *Blockley* 473 (PERTH) (5); *Broadbent*, 50 mi SW of Yalgoo (CANB) (6); *Brockway* 6 (PERTH) (5); *Burbidge* 64 (PERTH) (4); *Burns* 3, 4, 5-5 June 1968 (PERTH) (6); *Burns* 46 (PERTH) (5); *Burns* 5-6 Nov. 1965 (PERTH) (5); *Burns* 65, 101, 106, 107 (PERTH) (1); *Burns* 84 (PERTH) (5); *Burns* 85 (PERTH) (4); *Burns* 96 (PERTH) (4); *Burns*, Wicherina (PERTH) (1); *Campbell* 56 (BRI) (6); *Campbell*, Nagade, Mingenew (PERTH) (6); *Chadwick* 1700 (PERTH) (1); *Chapman*, Coorow-Winchester (PERTH) (1); *Chapman*, nr Morawa (PERTH) (6); *Cole* 3/21 (PERTH) (5); *Cranfield* 663 (PERTH) (6); *Cranfield* 666 (PERTH) (5); *De Rebeira* 204 (PERTH) (6); *De Rebeira* 36 (PERTH) (6); *Delahunty*, Wubin (PERTH) (5); *Demarz* 1882 (PERTH) (4); *Demarz* 256 (PERTH) (5); *Demarz* 2601 (PERTH) (6); *Demarz* 5124 (PERTH) (6); *Demarz* 5158 (PERTH) (3); *Demarz* D5588 (PERTH) (6); *Demarz* D7429 (PERTH) (6); *Demarz* D7557 (PERTH) (5); *Diels & Pritzel* 517 (PERTH) (5); *Diels* 5231 (PERTH) (6); *Diels* 5571 (PERTH) (5); *Doing*, 50 mi W of Coolgardie (CANB) (5); *Elliot*, nr Useless Loop (PERTH) (3); *Fairall* 1038 (PERTH) (6); *Fairall* 1206 (PERTH) (3); *Forrest*, nr Lake Dehorah (MEL) (6); *Franks*, nr Coolgardie (PERTH) (5); *Galbraith* 248 (AD, MEL) (2); *Galbraith*, Wilroy (MEL) (6); *Gardner* 1118 (PERTH) (4); *Gardner* 12022 (PERTH) (5); *Gardner* 12058 (PERTH) (6); *Gardner* 12087 (PERTH) (6); *Gardner* 12159 (PERTH) (5); *Gardner* 12254 (PERTH) (5); *Gardner* 12458 (PERTH) (6); *Gardner* 13286, 13314 (PERTH) (4); *Gardner* 13313, 13316 (PERTH) (2); *Gardner* 13344 (PERTH) (6); *Gardner* 13532 (PERTH) (6); *Gardner* 13536 (Perth) (5); *Gardner* 14372 (PERTH) (6); *Gardner* 2669 (PERTH) (6); *Gardner* 6457 (PERTH) (6); *Gardner* 7776 (PERTH) (5); *Gardner* 830 (PERTH) (6); *Gardner*, 50 mi N of Northampton (PERTH) (4); *Gardner*, Cue (PERTH) (5); *Gardner*, Karalee (PERTH) (5); *Gardner*, Yorkrakine (PERTH) (5); *Gardner*, nr Korrelocking (PERTH) (5); *Gardner*, nr Youanmi (PERTH) (5); *George* 14345 (PERTH) (6); *George* 1455 (PERTH) (2); *George* 1489 (PERTH) (5); *George* 5673 (PERTH) (6); George 7881 (PERTH) (1); *Gittins* 1512 (BRI, NSW) (2); *Gray*, Trayning (PERTH) (6); *Green* 1521 (PERTH) (6); *Green* 1527 (PERTH) (5); *Green* 1534 (PERTH) (6); *Green* 1545A (PERTH) (6); *Green* 1575 (PERTH) (6); *Green* 4638, 4658 (PERTH) (5); *Green* 4656 (PERTH) (6); *Green* 4657 (PERTH) (6); *Gregory*, Northam (PERTH) (6); *Grieve*, Ballidu area (UWA) (6); *Grieve*, Kellerberrin-Doodlakine (UWA) (5); *Hart* 15 (PERTH) (6); *Holm*, Talisker station (PERTH) (2); *Howard* and *Houston* 331-5 (PERTH) (3); *Howard* and *Houston* 338-7 (PERTH) (2); *Humphries* M31343 (PERTH) (5); *Hursthouse*, Murchison dist. (NSW7064, PERTH) (1); *Kelso*, Coolgardie (PERTH) (5); *Koch* 1091 (NSW, PERTH) (5); *Loneragan*, 12.7 mi S of Coorow (UWA) (1); *Long* 50 (PERTH) (1); *Luff* and *Birrel* 34 (AD) (5); *Lullfitz* 2476 (PERTH) (6); *Lullfitz* 3827 (PERTH) (6); *Lullfitz* L1622, 2031 (PERTH) (5); *Lullfitz* L2890, 2984, 2991, 3078, 3215 (PERTH) (5); *Lullfitz* L2897, 2907 (PERTH) (4); *Lullfitz* L2947 (PERTH) (1); *Main*, 61 mi W of Coolgardie (PERTH) (5); *Main*, Bonnie Rock-Wialki dist. (PERTH) (6); *Mason*, Wanarra sta. (PERTH) (6); *Mason*, nr Lake Monger (PERTH) (5); *McGauran*, Geraldton (PERTH) (4); *Merrall*, Golden Valley (MEL) (6); *Monck*, S of Geraldton (PERTH) (1); *Mueller*, N of Murchison R (MEL76002) (5); *Muir* 209 (PERTH) (6); *Muir* 63 (PERTH) (6); *Nathan*, bet. Coolgardie and Bullabulling (PERTH) (5); *Nelson* ANU17340, 17342 (PERTH) (3); *Newbey* 1546 (PERTH) (5); *Newbey* 1690 (PERTH) (6); *Newbey* 2041 (PERTH) (6); *Newbey* 2087 (PERTH) (6); *Newbey* 2095 (PERTH) (6); *Newbey* 2143 (PERTH) (5); *Newbey* 2199 (PERTH) (2); *Newbey* 6062 (PERTH) (5); *Newbey* 8983 (PERTH) (5); *Newbey* 8995 (PERTH) (6); *Newbey* 9442 (PERTH) (6); *O'Grady*, Gnangara (PERTH) (5); *Orchard* 4189 (AD, PERTH) (5); *Paust* 1288 (PERTH) (4); *Perry, D. H.*, Yuna (PERTH) (1); *Perry, D. H.*, nr Yuna (PERTH) (5); *Perry, D. H.*, prope Mullewa (PERTH) (4); *Perry, G.* 587 (PERTH) (4); *Phillips*, 18 mi S of Morawa (PERTH) (5); *Phillips*, 2 mi N of Tardun (CBG019320, NSW) (5); *Phillips*, 3 mi E of Mullewa (CBG038976) (6); *Phillips*, 6 mi E of Mullewa (BRI, CBG038685, MEL, NSW) (6); *Phillips*, 9 mi NNW of Ballidu (CANB036524, PERTH) (5); *Phillips*, Daisy Downs, 12 mi fr. Mullewa (CBG013832, NSW) (4); *Phillips*, N of Murchison R (BRI, CBG622585) (4); *Phillips*, Pindar (AD, CBG027475) (6); *Phillips*, c.14 mi S of Wannoo (PERTH) (5); *Phillips*, c.14.5 mi S of Wannoo (CBG034980, NSW) (5); *Powell* 73104 (PERTH) (5); *Powell* 74047 (PERTH) (6); *Powell* 74103 (PERTH) (1); *Pritzel* 862 (NSW) (5); *Rogerson* 315 (PERTH) (5); *Rosier* 372 (PERTH) (6); *Rosier* 376 (PERTH) (5); *Royce* 5046 (PERTH) (6); *Royce* 5491 (PERTH) (6); *Royce*, Chandler (PERTH) (6); *Russell*, Jibberding (PERTH) (5); *Rye* 76014 (PERTH) (5); *Sargent*, Latham (PERTH) (6); *Scrymgeour* 1479, 1521 (PERTH) (5); *Scrymgeour* 1535 (PERTH) (6); *Sewell*, Swan R (MEL) (6); *Sharr* 3610 (PERTH) (5); *Shaw* 609 (AD, PERTH) (5); *Smith* 66/301 (PERTH) (4); *Smith* 66/412 (PERTH) (5); *Stacey* 254 (PERTH) (5); *Stacey* 688, 692, 693 (PERTH) (5); *Storr*, 12 mi NW of Wialki (PERTH) (6); *Thomson*, bet. Geraldton and Mullewa (PERTH) (4); W----, c. 50 mi W of Mullewa (UWA) (5); *Webster* 65 (NSW) (5); *Webster*, Coolgardie (NSW136165) (4); *Wemm* 913B (PERTH) (4); *Whibley* 4647 (AD) (5); *White* 5473 (BRI) (5); *White* 630814 (PERTH) (5); *White*, 7 mi S of Coolgardie (PERTH) (5); *Willis*, 58 mi W of Coolgardie (MEL, NSW136238) (5); *Wilson* 11576 (PERTH) (5); *Wilson* 3519 (PERTH) (5); *Wittwer* 1234 (PERTH) (6); *Wittwer* 1244 (PERTH) (5).

Taxonomy of *Micromyrtus ciliata* (Myrtaceae) and allied species including three new species of *Micromyrtus* from eastern Australia and lectotypification of *M. minutiflora*

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Abstract

Green, J. W. Taxonomy of *Micromyrtus ciliata* (Myrtaceae) and allied species including three new species of *Micromyrtus* from eastern Australia and lectotypification of *M. minutiflora*. Nuytsia 4(3): 317-331 (1983). *Micromyrtus ciliata* is redefined in consequence of the segregation from it of two new species, *M. sessilis* and *M. striata*. A third new species, *M. blakelyi*, belonging to the same group, is also described. All four species are mapped and illustrated. *Micromyrtus minutiflora*, based on mixed material, is lectotypified.

A. Taxonomy of *Micromyrtus ciliata* and allied species

Introduction

The stimulus for the present paper came from the need to provide a name for an undescribed species of *Micromyrtus* occurring in the region of the forthcoming flora of SE Queensland. The opportunity was taken to treat at the same time the whole *M. ciliata* group of four species, comprising *M. ciliata*, two segregates from it (*M. sessilis* and *M. striata*), and an undescribed species (*M. blakelyi*) based on material in herb. NSW which had been described and put aside by W. F. Blakely many years ago but never published.

Since the present group of species is being treated somewhat out of context, it may be useful to indicate its place in the classification of the genus.

Following the removal of three species to *Malleostemon* (Green 1983), *Micromyrtus* now contains some 19 published species, as well as 3 not yet described. Bentham, who described first the genus (in Bentham and Hooker 1865) and later (1867) seven species, established in his key to the species what have come to be regarded as the chief diagnostic characters: stamen number; ovule number; and shape of calyx-tube (here called floral tube). Bentham suggested no infrageneric classification, nor has one been proposed since, despite the description of many additional species.

On the basis of Bentham's characters, *Micromyrtus* may be divided informally into 5 sections, one of which contains all seven eastern species. Six of its member species exhibit the typical character syndrome of floral tube basally 5-ribbed; sepals and petals 5; leaf margin minutely ciliate; and ovules 2, 4 or 6. The seventh species, the hexamerous *M. hexamera* (Maiden et Betche) Maiden et Betche, differs from the numerical characters above but is obviously related on flower and leaf morphology (see Green 1980b, where the remarkable, parallel example of hexamery in a species of *Thryptomene* from the same area is also discussed).

Within the '*M. ciliata* section', the '*M. ciliata* group' contains 4 species united by ovule number 4, in contrast to the other 3 species which have ovule numbers 2 (*M. minutiflora* Benth.), 6 (*M. leptocalyx* (F. Muell.) Benth.) or 8 or more (*M. hexamera*).

Study methods and specialised terminology are as explained by Green (1979, 1980a and 1980b). The study was restricted to material in Australian herbaria, and descriptions drawn up from a small representative selection. Specimens cited are arranged geographically within States or Territories, the selection attempting to reflect morphological variation, habitats, history and representation in herbaria. The species are arranged in systematic order, beginning with *M. ciliata* and ending with the most distantly-related species in the group. The term bracteole is used for the structures subtending the flower. With the removal of all multi-flowered species to *Malleostemon* (Green 1983), my interpretation of the solitary flower of *Thryptomene*, *Micromyrtus* and *Corynanthera* as a 1-flowered inflorescence, and my reserving the term bract for structures subtending a flower-cluster, might now seem unnecessary. Nonetheless, I have retained the usage for the sake of consistency among the four genera. A character known for only one or two species is usually omitted from the descriptions of species for which it is unknown.

Key to the species

1. Leaf keel glabrous; margins of sepals minutely denticulate or entire; stamens and style about 1 mm long
    2. Ribs of floral tube one adaxial and four twisted and contiguous in two lateral pairs flanking the compressed base of the tube. Widespread in central and SE N.S.W., W Vic. and SE S.A. . . . . 1. *M. ciliata*
    2. Ribs of floral tube 5-8, not twisted and basally contiguous, though sometimes branching under the sepals; tube not markedly compressed
        3. Ribs of floral tube 5, some obtusely branching near the calyx; disc straight. Tablelands of SE Qld and N N.S.W. . . . . 2. *M. sessilis*
        3. Ribs of floral tube up to 8, branching acutely near the base; disc oblique. W plains of N.S.W. . . . . 3. *M. striata*
1. Leaf keel ciliate; margins of sepals fimbriate; stamens and style mostly above 2 mm long. Hawkesbury, N.S.W. . . . . 4. *M. blakelyi*

Species descriptions

1. **Micromyrtus ciliata** (Sm.) Druce, Rep. Bot. Exch. Cl. & Soc. Br. Isles 1916, Suppl. 2 636 (1917). *Type:* Port Jackson, 1795, *White* (holo: LINN, examined B. R. Maslin; photo: PERTH). (Figures 1-15)

Imbricaria ciliata Sm., Trans. Linn. Soc. 3: 259 (1797).

Escallonia ciliata (Sm.) Schult. in Roem. et Schult., Syst. 5: 329-330 (1819).

Stereoxylon ciliata (Sm.) Poir., Dict. Suppl. 5: 247 (1847).

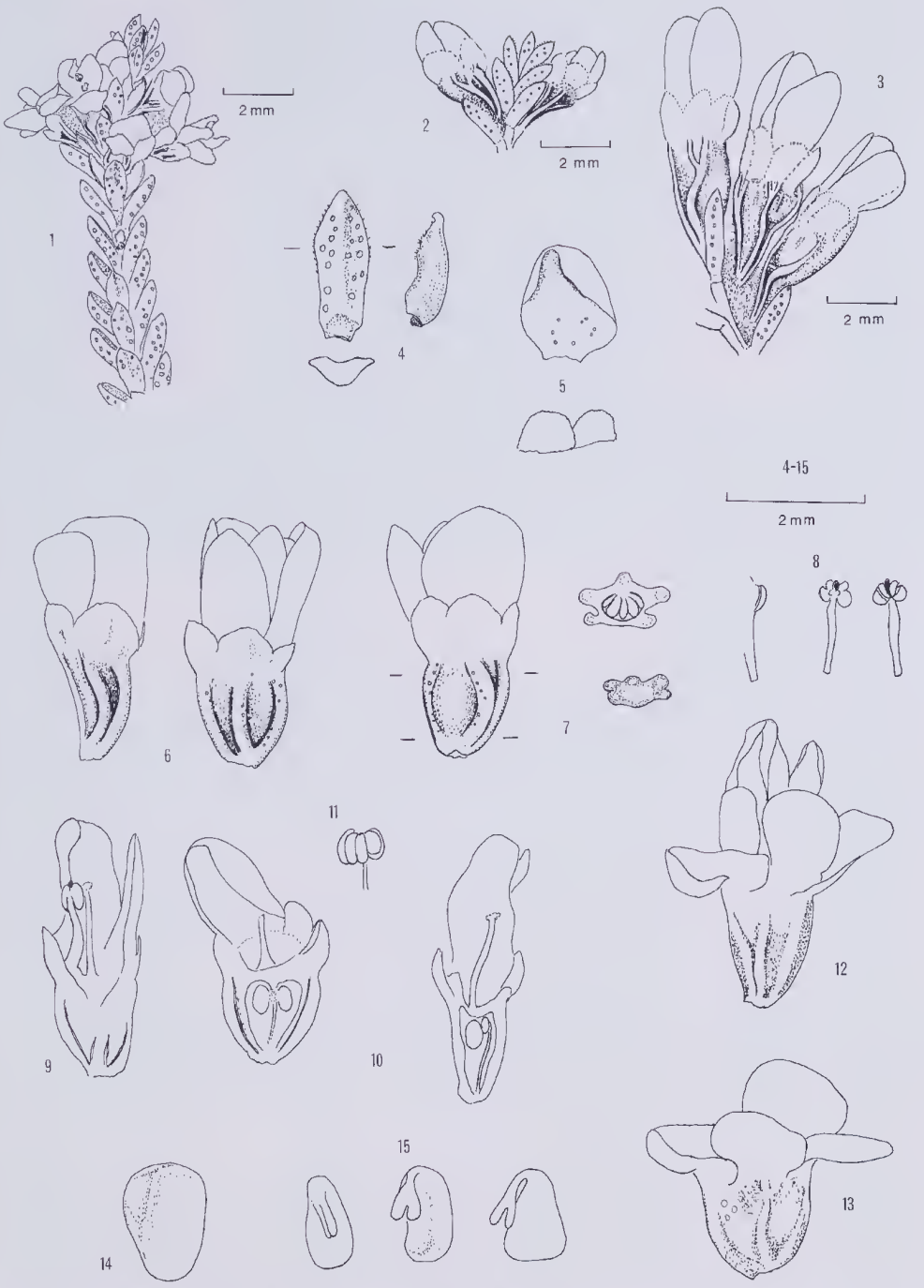
Thryptomene ciliata (Sm.) F. Muell. ex Woolls, Pl. Neighb. Sydney 23 (1882).

Baeckea microphylla Sieb. ex Spreng., Syst. Veg. Cur. Post., 149 (1827). *Type:* Nov. Holl. *Sieber* 282 (holo: n.v.; iso: MEL 71255, 71264).

Micromyrtus microphylla (Sieb. ex Spreng.) Benth., Fl. Austral. 3: 65 (1867), nom. illeg.

Baeckea plicata F. Muell., Fragm. Phyt. Austral. 1: 30 (1858). *Type:* Grampians, *F. Mueller* (holo: MEL 71233).

Thryptomene plicata (F. Muell.) F. Muell., Fragm. Phyt. Austral. 4: 63-64 (1864).



Figures 1-15. *Micromyrtus ciliata.* 1—Upper flowering branch. 2—Flowers, typical form. 3—Flowers, A.C.T. form. 4—Leaf showing median TS (left); bracteole (right). 5—Petal (upper) and sepals (lower). 6—Flower, lateral (left), adaxial (right). 7—Flower, oblique radial view; TS floral tube, upper and lower. 8—Stamens. 9-10—Flower, dissected to show stamens, style and ovules. 11—Ovules and part of stylar vein. 12-13—Fruiting perianths. 14—Seed. 15—Embryos.

1, 5-11 from *R. Coveney,* W of Hornsby, 11 Sep. 1966; 2 from *Whaite* 1600; 3 from *Darbyshire* 40; 4 from *Anon,* Port Jackson (AD); 12-13 from *Reader,* 25 Oct. 1896; 14-15 from *Krachenbuehl* 1258.

Shrub, spreading to erect, 0.3-1.2 m high. *Leaves* imbricate, opposite, decussate, obovate to oblong or linear, concavo-convex, somewhat keeled below, 1.5-4 mm long, 0.4-1 mm broad, subsessile, dotted with several oil glands, glabrous except the margins minutely ciliate or rarely entirely glabrous. *Flowers* subsessile, solitary in the upper axils, forming loose to compact terminal heads; *bracteoles* subtending the flower 2, conduplicate, 1.5-2 mm long, mostly deciduous. *Floral tube* dorsiventrally compressed-obconical, especially near the base, 2-5 mm long; ribs 5, antesepalous, sometimes branching obtusely just below sepals, adaxial rib linear, lateral pairs twisted, the ribs of each pair becoming contiguous in the lower half, one pair to either side of the broad, convex, smooth, abaxial surface of the tube. *Sepals* 5, semiorbicular, 0.7-1 mm long, sometimes pink, margins minutely irregularly denticulate, fimbriate or entire. *Petals* 5, broadly elliptic, 1.7-4 mm long, 1-2 mm broad, white to pink. *Disc* deeply concave. *Stamens* 5, antepetalous, not exceeding the petals; *filaments* filiform, 1-1.3 mm long; *anthers* versatile, bisporangiate, bilocular, 0.3 mm long, stomia linear, subparallel; *connective gland* small, globular. *Style* 1.5 mm long, equalling or exceeding the sepals. *Ovules* 4 (very rarely 5), radially arranged about a small placenta attached to the stylar vein near the summit of the ovary. *Fruit* somewhat enlarged from the flower, sepals persistent, becoming enlarged, hardened and spreading. *Seeds* 1 or rarely 2, broadly ovoid-obloid, 1.5 x 1 mm, somewhat angular; *embryo* with a broadly clavate, somewhat angular hypocotyl, a narrow, curved neck and 2 small, linear cotyledons lying against the hypocotyl.

Selection of specimens examined. NEW SOUTH WALES: Gungal, near Merriwa, Sep. 1904, *J. L. Boorman* (NSW); Bumberry Mountain, near Parkes, 1947, *G. W. Althofer* (NSW); About 10 miles (16 km) S of Cowra, 24 Nov. 1945, *C. W. E. Moore* (CANB); Gosford, *Harris* and *Butler* (NSW); Port Jackson, 1838, *T. Siemssen* (MEL); South Head, Sydney, 3 Sep. 1910, *J. B. Cleland* (AD); Long Bay, 4 Oct. 1927, *A. Morris* (ADW): Springwood, 13 Sept. 1929, ex herb. *Rodway* 2945 (NSW): Jervis Bay, Sept. 1928, *Anon.* (NSW); c. 8 miles (12.9 km) SW of Nowra, *E. F. Constable* 1276A (NSW).
AUSTRALIAN CAPITAL TERRITORY: Along Gibraltar Creek, *R. Schodde* 3155 (AD, BRI, CANB, MEL, NSW); Mount Tennent, 2 Nov. 1952, *L. D. Pryor* (AD, CBG); Punchbowl Creek, *N. T. Burbidge* 6811 (CANB, NSW).
VICTORIA: c. 50 km NNW of Orbost, 24 Apr. 1957, *J. H. Willis* (MEL); 15 miles (24.1 km) NNE of Bendigo, *H. I. Aston* 432 (MEL); Wimmera, *Dallachy* (MEL): Grampians, *T. B. Muir* 2567 (MEL); Wyperfeld National Park, *B. G. Briggs* 2868 (NSW): Serviceton, 1887, *Turner* (MEL).
SOUTH AUSTRALIA: 40 miles (64.4 km) N of Bordertown, 15 miles (24.1 km) E of Bunn's Bore, 22 Oct. 1958 *G. Blackburn* (ADW); c. 97 km N of Bordertown, *P. G. Wilson* 2129 (AD); 4 miles (6.4 km) W of Murray Bridge, 9 Oct. 1953, *F. M. Hilton* (ADW).

Distribution and habitat. Distributed widely in two disjunct areas, one in central and south-eastern N.S.W. (including the A.C.T.) and the other in western Victoria and the south-east of S.A. (Map 1), *Micromyrtus ciliata* has been recorded from a wide variety of habitats, including rocky declivities (both tableland and coastal) and sand heaths. The scanty records of associated flora include *Angophora, Eucalyptus racemosa, E. haemastoma* and *Pomaderris,* in communities such as mallee, mallee scrub, mallee broombush, sclerophyll forest and low open heath. The altitudinal range is from sea level to 1 000 m.

Flowering and fruiting period. Flowering, March-April, July to November, chiefly September-October with a peak in October; fruiting, October-December.

Micromyrtus ciliata is here circumscribed on the character of the compressed floral tube and its unevenly-disposed ribs, four of which twist and become contiguous in two pairs below. This striking arrangement seems never to have been described, nor has it been adequately illustrated. The following new species are separated from *M. ciliata* on the basis of the ribs being much more evenly disposed and not becoming contiguous in pairs, as well as the tube being less markedly compressed below or not compressed.

Even after the removal of the above segregates, *M. ciliata* remains a very variable species. On some mountains, especially Mount Tennent, A.C.T., large-flowered populations are in marked contrast to the typical form from around Sydney; however, as the two are joined by a range of intermediates, I have been unable to delineate formal taxa. The flowers are recorded as pink in the bud and white at anthesis; many populations, however, show varying degrees of pinkness in petals and sometimes also sepals, some being deeply pigmented. So far, this variation has not been correlated with habitat. There may be a case for establishing infraspecific taxa based

Map 1. Distribution of *Micromyrtus ciliata* (closed circles) and *M. sessilis* (open triangles).

on habit: Willis (1973) refers to two distinct forms in Victoria—a sprawling, often procumbent, heavily-pigmented inhabitant of rocky places, and a stiffly-erect, white-flowered bush occurring on mallee sandhills. Clarification of the taxonomic nature of these forms will probably have to await a field study, as present collections and label data are not adequate for the purpose.

Conservation status. Probably not endangered, being common and widespread; recorded from at least one National Park.

2. **Micromyrtus sessilis** J. W. Green, sp. nov. (Figures 16-27)

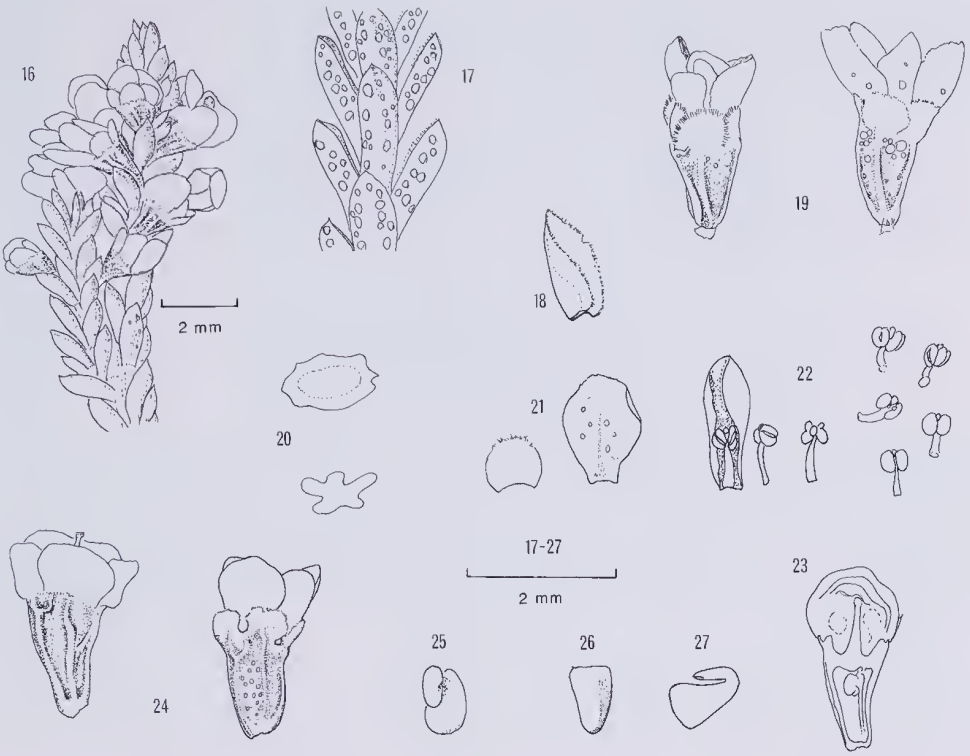
Micromyrtus minutiflora Benth., Fl. Austral. 3: 65 (1897), pro parte excl. lectotype, as to New England, *Stuart* (MEL 71351, 71258).

Frutex; folia linearia ad oblanceolata, 1.5-3 mm longa; *flores* solitarii, axillares, sessiles vel subsessiles; *tubus floris* obconicus ad anguste turbinatus, 5-costatus; costae aliquantum incongruae; *petala* et *sepala* 5; *stamina* 5, antisepala; *ovula* 4.

Typus: 2 km S of Miles, Queensland, 12 October 1977, *J. W. Green* 4675 (holo: BRI; iso: NSW, PERTH).

Shrub, usually dense, spreading, 0.6-1.5 m high, sometimes smaller or even prostrate. *Bark* deciduous in strips or flakes, brown to grey. *Leaves* usually imbricate, opposite, decussate, linear to oblanceolate, 1.5-3 mm long, about 0.5-0.8 mm broad and thick, sessile, concave above, keeled below near the apex otherwise rounded, dotted with several oil glands, glabrous except the margins minutely ciliate. *Flowers* sessile or subsessile, solitary in the upper axils, forming small compact heads to massive flowering regions; *bracteoles* subtending flower 2, about 1.5 mm long, deciduous. *Floral tube* obconical to narrow-turbinate, 1-1.4 mm long; ribs 5, somewhat irregularly disposed, rounded, longitudinal, sometimes branching obtusely below the sepals, not markedly contiguous in the lower half, often glandular; intercostal interstices usually smooth or sometimes glandular. *Sepals* 5, semiorbicular, 0.3-0.7 mm long, margins usually minutely denticulate. *Petals* 5, orbicular to elliptic, 0.7-1.5 mm long, 0.6-1 mm broad, white or pale pink, sometimes bearing several oil glands, margins entire. *Disc* shallow. *Stamens* 5, antepetalous, shorter than the petals; *filaments* filiform, 1 mm long; anthers versatile, bisporangiate, bilocular, 0.3 mm long, stomia subparallel; connective gland small, globular. *Style* about 1 mm long, exceeding the sepals. *Ovules* 4, radially arranged about a small placenta attached to the stylar vein near the summit of the ovary. *Fruit* scarcely enlarged, petals sometimes persistent. *Seed* 1, broadly compressed-clavate, somewhat angular, 1.5 x 0.7 mm, pale brown; *embryo* with a broadly clavate, somewhat angular hypocotyl, a narrow, curved neck and 2 small, linear cotyledons lying against the hypocotyl.

Selection of specimens examined. QUEENSLAND: 35 miles (56.3 km SW of Roma, *L. Pedley* 2411 (BRI); 6 miles (9.7 km) E of Yuleba, *S. L. Everist* 6139 (BRI, CANB); Wyberba, Bald Rock Creek, 6 miles (9.7 km) S of Stanthorpe, *L. Pedley* 1555 (BRI, CANB); Between 2 peaks of Mount Norman, about 5 miles (8 km) NE of Wallangarra, 6 Dec. 1970, *D. Hockings* (BRI).



Figures 16-27. *Micromyrtus sessilis*. 16—Upper flowering branch. 17—Leaves. 18—Bracteole. 19—Flowers, lateral and abaxial views. 20—Floral tube, TS, upper and lower. 21—Sepal (left) and petal (right). 22—Stamens, one with attached petal. 23—Longitudinal half flower, showing style and ovules. 24—Fruits. 25—Ovules, developing. 26—Seed. 27—Embryo.

16-17, 24 (left) from *Jackson* 2276; 18, 20, 22-23 from *Green* 4675; 19, 21, 25 from *Everist* 8122; 24 (right), 26-27 from *Boorman*, Wallangarra.

NEW SOUTH WALES: 55 miles (88.5 km) NW of Grafton on Gwydir Highway, Gibraltar Range, 13 Dec. 1966, *M. D. Tindale* (NSW); Torrington-Tungsten road, 15 miles (24.1 km) NW of Deepwater, 13 May 1961, *E. F. Constable* (NSW); Howell, Sep. 1905, *R. Hart* (NSW); 14 miles (22.5 km) S of Narrabri, 26 Aug. 1961, *M. E. Phillips* (BRI, CBG); Mount Exmouth, Warrumbungles, 26 May 1948, *E. F. Constable* (NSW); Dubbo-Gilgandra, 12-14 miles (19.3-22.5 km) N of Dubbo, *H. Salasoo* 3779 (NSW); Rankins Springs, Sep. 1964, *M. W. Browne* (NSW); Griffith district, *T. Vanden Brock* 676 (NT); Between Sassafras & Mount Effrema, 20 miles (32.1 km) SW of Nowra, ex herb *F. A. Rodway* 12427 (NSW).

Distribution and habitat. Micromyrtus sessilis occurs from around Miles in south-eastern Queensland to Griffith in south-central New South Wales, mainly on the Great Divide above 600 m elevation (Map 1). The few available records of associated vegetation include mallee, scrub, forest and open woodland, containing species of *Eucalyptus (E. crebra, E. sideroxylon* and *E. exserta), Acacia, Callitris* and *Melaleuca*. Rocky habitats are noted frequently on specimen labels, while soils vary from sand to clay, specifically solodized solonetz, sandy clay and red-brown sand over clay.

Flowering and fruiting period. Flowering, March, May, July-November, chiefly September-October; fruiting, January-February (N.S.W.), September-October, December (Qld.).

Micromyrtus sessilis is segregated from the closely-related *M. ciliata* from which it differs in the following characters: floral tube scarcely compressed; ribs of floral tube not twisted and contiguous near the base; oil glands often prominent on the tube just below the sepals; and distribution more northerly, principally SE Queensland and the New England tablelands of N.S.W.

As long ago as 1958, what is now *M. sessilis* was recognized as being an undescribed species by S. T. Blake (herb. BRI, in sched., Sep. 1958) when he discovered the mixed nature of Bentham's (1867) syntypes of *M. minutiflora* (see also discussion in section B, below, where *M. minutiflora* is lectotypified).

Conservation status. Not endangered owing to occurrence in mountainous areas relatively free from alienation.

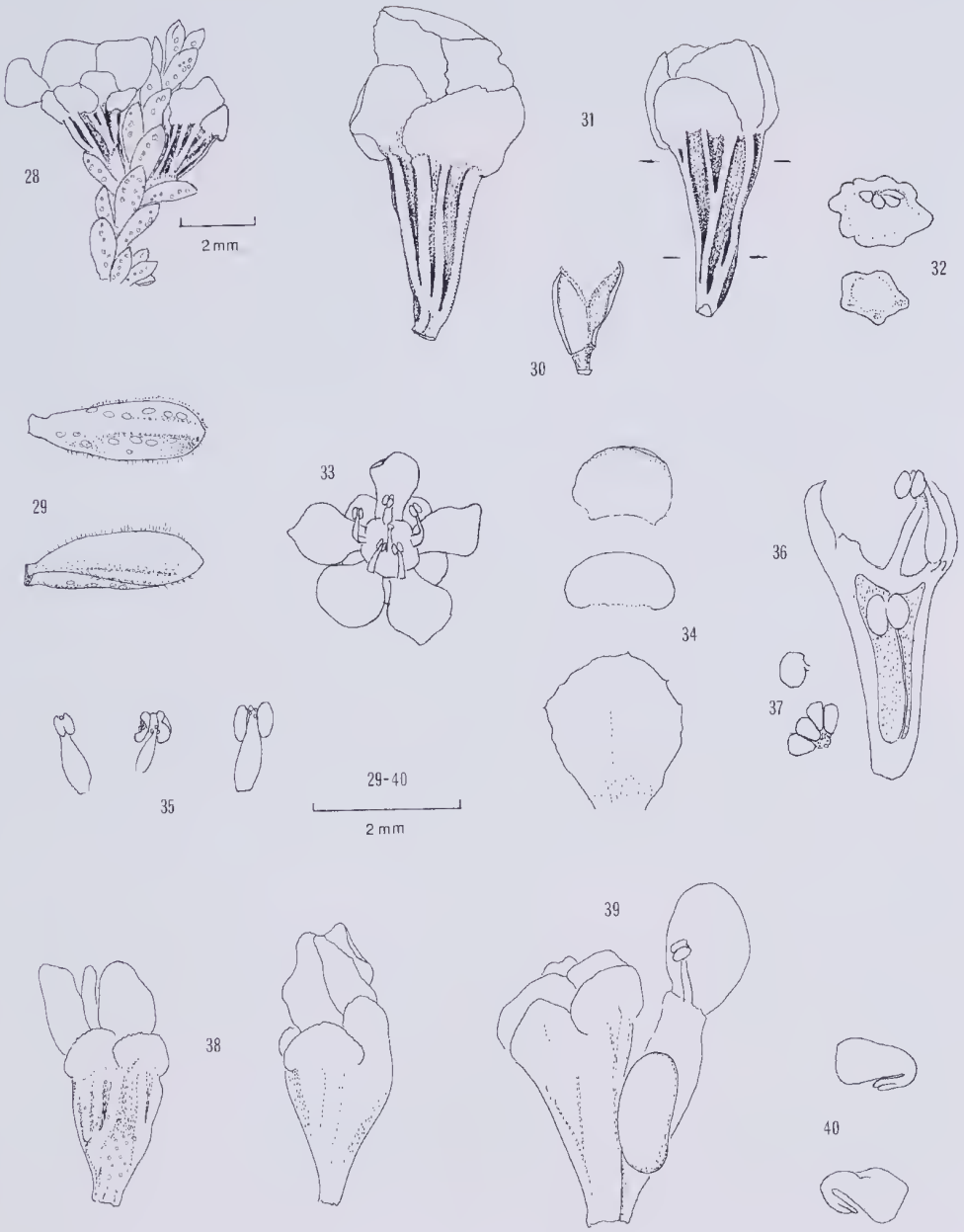
Etymology. The epithet refers to the sessile or subsessile flowers which distinguish the species from *M. leptocalyx* in SE Queensland where the two sometimes occur together.

3. **Micromyrtus striata** J. W. Green, sp. nov. (Figures 28-40)

Frutex; folia obovata, 1-2 mm longa; *flores* solitarii, axillares, subsessiles; *tubus floris* obconicus, usque ad 8-costatus, costae prope tubi basin ramosae; *sepala* et *petala* 5; *stamina* 5, antisepala; *ovula* 4.

Typus: 5.5 miles (8.8 km) S of Tottenham, New South Wales, 7 Sep. 1962, *T. & S. Whaite* 2525 (holo: NSW).

Shrub, erect to spreading or drooping, 1-1.2 m high. *Leaves* sessile or nearly so, imbricate, opposite, decussate, obovate, concave or grooved above, rounded to somewhat keeled below, 1-2.5 (rarely to 6) mm long, 0.5-1 mm broad, dotted with several to many oil glands, glabrous except the margins minutely ciliate. *Flowers* subsessile, solitary in the upper axils, forming more or less terminal clusters of 5-10; *bracteoles* subtending the flower 2, membranous, 0.6-1 mm long, deciduous. *Floral tube* obconical, 1-2.5 mm long, somewhat oblique at the disc; *ribs* up to 8, when dry prominently standing out from the tube, smoothly rounded, acutely dividing from 5 quite near the base, more or less evenly disposed around the tube. *Sepals* 5, petaloid, semiorbicular, sometimes minutely auriculate, 0.6-0.8 mm long, 0.7-1.2 mm broad. *Petals* 5, broadly elliptic, 1.4-2 mm long, 1.3-1.6 mm broad, white. *Disc* concave, sometimes deeply so. *Stamens* 5, antepetalous, slightly exceeding the sepals; *filaments* filiform or clavate, 1 mm long, *anthers* versatile, globular, 0.3-0.4 mm diameter, bisporangiate, bilocular, stomia subparallel; *connective gland* small, solitary or accompanied by 2 or 3 lateral glands. *Style* about 1 mm long, exceeding the sepals. *Ovules* 4, radially arranged about a small placenta attached to the stylar vein near the summit of the ovary; inner ovary wall loosely fibrous. *Fruit* scarcely enlarged from the flower, sometimes swollen eccentrically, the ribs less prominent than in the flower. *Seed* usually 1, rarely 2 or 3, somewhat reniform, 1.5 x 0.7 mm; *embryo* with a thick, clavate hypocotyl, narrow, curved neck and 2 small, linear cotyledons.



Figures 28-40. *Micromyrtus striata*. 28—Upper flowering branch. 29—Leaves, dorsal and lateral views 30—Bracteoles. 31—Flowers. 32—Flower, TS floral tube, upper and lower. 33—Flower, from above. 34—Sepals (upper, middle) and petal (right). 35—Stamens. 36—Longitudinal half-flower showing stamen, style and ovules. 37—Ovules, lateral and vertical. 38—Fruits. 39—Fruit, dissected to show seed. 40—Embryos.

28-34 (upper and middle) from *Moore* 5273; 34 (lower)-37 from *Whaite* 2525; 38 (left) from *Abraham*, Cobar, Oct. 1911; 38 (right)-39 from *Constable* 4547; 40 from *Boorman*, S of Cargellico.

Selection of specimens examined. NEW SOUTH WALES: c. 25 miles (40.2 km) SE of Louth, *C.W.E. Moore* 4189 (NSW); Between Bogan and Darling, 1877, *L. Morton* (MEL); Cobar, 1886, *J. M. Curran* (MEL); 35 miles (56.3 km) S of Bourke, *E. F. Constable* 4547 (BRI, NSW); SW of Dandaloo, 21 Jun. 1900, *R. H. Cambage* (NSW); 48.5 miles (78 km) S of Cobar, *C. W. E. Moore* 4493 (CANB, NSW); 13 miles (20.9 km) SE of Hillston, 21 Mar. 1959, *E. F. Constable* (NSW); Lachlan River, 1872, *L. Morton* (MEL); Bulbodney S.F., near Condobolin, 8 Oct. 1932, *V. H. Hadley* (NSW); Wyalong, *R. H. Cambage* 122 (NSW); Griffith, Jul. 1928, *W. F. Blakely* & *D. W. C. Shiress* (NSW); 1 mile (1.6 km) W of Kamarah, Sep. 1966, *S. Cadwell* (NSW); Lake Cudgellico [now Cargellico], 2 Oct. 1906, *J. L. Boorman* (NSW); Mount Lindsay, Nandewar Range, 5 Nov. 1909, *R. H. Cambage* (NSW).

Distribution and habitat. Micromyrtus striata is widespread in central New South Wales, from Louth to Griffith, with an outlier in the Nandewar Range (Map 2). It has been recorded in mallee, heathland and woodland, the only recorded associated species being *Eucalyptus populnea.* The substrate may include red sand, red earth, red clay loam or skeletal soil, sometimes poorly-drained.

Map 2. Distribution of *Micromyrtus striata* (closed circles) and *M. blakelyi* (closed triangle).

Flowering and fruiting period. Flowering, May, July-November, peaking September; fruiting, January, March, September-November.

Formerly included in *M. ciliata*, the new species is quite distinct in the floral tube which has up to 8 evenly-disposed ribs and is relatively symmetrically obconical. A variant (included above) with unusually long leaves, 4-6 mm long, has been recorded from Gloucester Buckets and Manna Mountain.

Conservation status. Not known to be endangered though the species needs monitoring owing to its common occurrence in habitats favoured for agriculture.

Etymology. The epithet refers to the prominent ribs on the floral tube.

4. **Micromyrtus blakelyi** J. W. Green, sp. nov. (Figures 41-53)

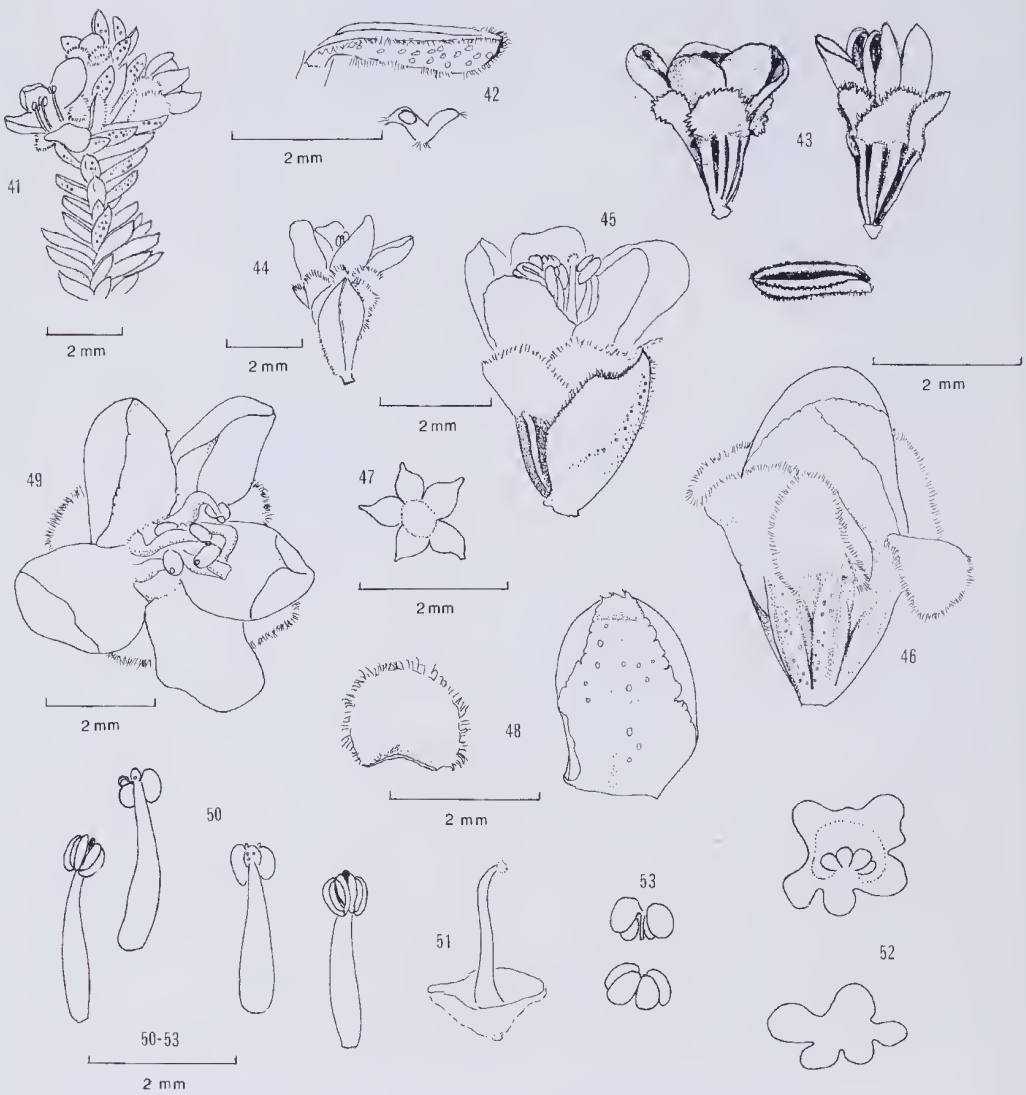
Frutex; folia linearia, 2.5-4.5 mm longa, carina ciliata; *bracteolae* ciliatae; *flores* solitarii, axillares, subsessiles; *tubus floris* turbinatus, basi 5-costatus, apice usque ad 10-costatus; *sepala* et *petala* 5; *calycis* margo ciliatus; *stamina* 5, antisepala, *ovula* 4.

Typus: Between Hornsby and Gosford, New South Wales, 23 September 1958, *E. Gauba* s.n. (holo: NSW 136205).

Shrub, low, cushion-like, 0.3-0.6 m high, forming dense masses; *young branches* and *leaves* densely woolly-tomentose. *Leaves* sessile or nearly so, imbricate, opposite, decussate, linear, deeply keeled, almost conduplicate, channelled above, 2.5-4.5 mm long, 1 mm broad, margins and keel ciliate, prominently so with silvery hairs when young, liberally dotted with oil glands. *Flowers* subsessile, solitary in the upper axils, forming loose, subterminal heads or elongated clusters; *bracteoles* 2, broad, keeled, rose-coloured, ciliate on margins and keel, 2.5-3 mm long, almost as long as the leaves and floral tube. *Floral tube* obconical, 2 mm long, regularly 5-cleft near the base, shining, reddish-brown; *ribs* 5 near the base, up to 8 above, acute or striated, branching acutely. *Sepals* 5, orbicular, 1.5-2 mm long, scarious, prominently fringed with long hairs. *Petals* 5, broadly elliptic, concave, 2-3 mm long, colour unrecorded, enclosing and exceeding the stamens; *margins* entire or sparsely denticulate or ciliate. *Disc* concave. *Stamens* 5, antepetalous, far exceeding the sepals and almost as long as the petals. *Filaments* filiform, 1.5-2 mm long; *anthers* 0.4 mm long, bisporangiate, bilocular, stomia subparallel. *Style* 2.5 mm long, exceeding sepals but not petals. *Ovules* 4, radially arranged about a small placenta attached to the stylar vein near the summit of the ovary. No fruits found.

Specimens examined. NEW SOUTH WALES: Hawkesbury to Cowan, 26 Jan 1918, *W. F. Blakely* (NSW); Hawkesbury River, old road above the convicts' bridge, 7 Oct. 1918, *W. F. Blakely* (NSW); Hawkesbury, about 2 miles (3.2 km) from station on old road, 24 Aug. 1919, *W. F. Blakely* (NSW); Hawkesbury River, Sep. 1925, *W. F. Blakely* (NSW); Canoe Grounds, 16 Oct. 1929, *W. F. Blakely* & *D. W. Shiress* (NSW).

Distribution and habitat. Micromyrtus blakelyi is very localised, having been recorded from very few localities, all near Hawkesbury (Map 2). The only indication of habitat is a manuscript note by Blakely in herb. NSW referring to his collection made in 1918 and that he made with Shiress in 1929: 'In both places it grows in the crevices of flat rocks.'



Figures 41-53. *Micromyrtus blakelyi*. 41—Upper flowering branch. 42—Leaf, lateral and TS. 43—Flowers and leaf, after Blakely (unpub.). 44-45—Bracteole and flower. 46—Flower, bracteoles removed. 47, 52—Floral tube, TS, upper and lower. 48—Sepal (left) and petal (right). 49—Flower, from above. 50—Stamens. 51—Style with attached disc. 53—Ovules.

41-42, 46-48, 50-53 from *Gauba*, Hornsby-Gosford, 23 Sep. 1958 (Type); remainder from *Blakely*, Hawkesbury River, 7 Oct. 1918.

Flowering and fruiting period. Flowering, August to October. Fruiting, unknown.

Micromyrtus blakelyi is distinguished from the remainder of the *M. ciliata* group by the indumentum of leaf keel, bracteole keel and sepal margin, as well as by the long stamens and style and cushion-like habit. W. F. Blakely, who made all except one of the collections, prepared drawings and drew up a description (all in herb.

NSW), commenting on the similarity to what is now *M. ciliata* but noting differences 'in its cushion-like habit, more densely ciliate leaves, large flowers, large and more highly coloured bracts' and 'more intensely ciliate' floral characters. Blakely thought the ovule number was 5, the calyx tube being 'easily separated into five divisions each of which usually contains one ovule'. The tube is indeed unusually deeply furrowed between the basal 5 ribs, but the ovary is unilocular, with 4 ovules as in all the *M. ciliata* group.

Conservation status. In view of its localised occurrence, not far from a large city, and the paucity of collections, particularly recent ones, this species must be classed as rare, probably endangered and possibly extinct.

Etymology. The epithet commemorates the discoverer, W. F. Blakely (1875-1941), formerly of the Sydney Botanic Gardens and later the National Herbarium of New South Wales.

Discussion

The species *Micromyrtus ciliata*, as formerly delineated, covered a broad and heterogeneous assemhlage of populations. Some progress has been made in delineating some of the more obvious taxa within this complex, such as *M. sessilis* and *M. striata*, largely by placing emphasis on the character of the ribbing of the floral tube. It is curious that the highly unusual tube of *M. ciliata* (sens. strict.) has not drawn comment previously, though I know from conversations that it has been observed. Nevertheless, *M. ciliata* remains quite variable, particularly in flower size, pigmentation and, according to Willis (1973), habit. Clarification of the variation pattern of *M. ciliata* may prove a fruitful topic for a biosystematic project, particularly for someone able to carry out detailed population studies in Victoria and the Australian Capital Territory.

The *Micromyrtus ciliata* section is not closely related to the four western sections. Only two sections, that containing *M. flaviflora* (F. Muell.) F. Muell. ex J. M. Black and *M. barbata* J. W. Green and one containing an undescribed species, have 5 stamens, but the floral tube is quite different. The remaining sections have 10 stamens and a narrow-cylindrical floral tube quite different from that of *M. ciliata*.

The conservation status of *M. blakelyi* is of particular interest: in view of the possibility that the species is on the verge of extinction, a special search should be mounted to try to locate, and possibly save the species. All of the other species of the group appear to be common and widespread, though they could be endangered if not represented in reserves. This would be worth documenting.

B. Lectotypification of Micromyrtus minutiflora

When S. T. Blake (herb. BRI, in sched., Sep. 1958) found that the syntypes of *M. minutiflora* Benth. represented two different taxa (one described here as *M. sessilis)* he wrote: "The specimens from Richmond do have two ovules and look rather different from ours. Stuart's New England ones agree with ours which must represent an undescribed sp." As the Stuart material is now allotted to *M. sessilis*, the remaining syntype, the Richmond collection by Wilhelmi, is proposed as the lectotype of *M. minutiflora*. This material agrees with Bentham's description in having ovules two, unlike Stuart's which agrees with *M. sessilis* and all other species of the *M. ciliata* group in having ovules four.

Micromyrtus minutiflora Benth., Fl. Austral. 3: 65 (1867). *Lectotype* (here designated): Near Richmond, November 1863, *C. Wilhelmi* s.n. (holo: MEL 71257).

Thryptomene plicata F. Muell. var. *minutiflora* F. Muell. ex Benth., loc. cit., nom. nud, pro. syn. sub *Micromyrtus minutiflora* Benth.

Thryptomene minutiflora (Benth.) F. Muell. ex Woolls, Pl. Neighb. Sydney 23 (1880).

Acknowledgements

It is a pleasure to acknowledge the assistance of my colleagues who readily discussed problems and provided ideas. In particular I want to thank Mr Paul G. Wilson who also provided essential guidance in nomenclatural matters and wrote the Latin descriptions. All those assisting on the technical side are thanked, particularly Mr R. J. Cranfield for his many hours of patient dissecting and slide preparation. The directors of herbaria who have made extended, long-term loans of specimens are thanked for their patience.

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Index to collections seen

Abraham, Cobar (NSW7019) (3); *Ackland 27*, 53 (MEL) (1); *Alcock* 111 (AD) (1); *Alcock* 6031 (PERTH) (1); *Alcock*, N of Bangham (AD) (1); *Althofer* 2 (NSW) (2); *Althofer* 47 (MEL) (2); *Althofer*, Bumberry Mt (NSW7025) (1); *Althofer*, Ganoo Forest 20 mi fr Dubbo (NSW7035) (2); *Anon.* 1484 (NSW) (1); *Anon.* 492 (NSW136207) (1); *Anon.*, Bet Mt Sassafras & Mt Ettrema (NSW136206) (2); *Anon.*, Denman (NSW136217) (2); *Anon.*, Forbes, (NSW136218) (1); *Anon.*, Jervis Bay (NSW136208) (1); *Anon.*, New England (NSW7003) (2); *Anon.*, Pt Jackson (AD, NSW6979) (1); *Anon.*, Willoughby (NSW6985) (1); *Anon.*, Wimmera (NSW7044) (1); *Ashby*, Grampians (AD) (1); *Ashby*, Grampians (ADW) (1); *Aston* 29 (MEL) (1); *Aston* 432 (MEL) (1); *Audas*, Mt Birchet (NSW7046) (1); *Barker*, 5 mi E Yuleba (BRI) (2); *Bauerlen?*, Cambewarra (MEL) (1); *Beauglehole* 19047 (AD) (1); *Beauglehole* 28835 (AD) (1); *Beckler*, L Korong (MEL) (1); *Blackburn*, 40 mi N Bordertown (ADW) (1); *Blake* 23787 (BRI) (2); *Blake* 2530 (BRI) (1); *Blake* 4665 (BRI) (2); *Blakely & Shiress*, Canoe Grounds (NSW7057) (4); *Blakely & Shiress*, Griffith (NSW7034) (3); *Blakely*, 2 mi W Wingello (NSW7014) (1); *Blakely*, Hawkesbury River (NSW7055, 7059) (4); *Blakely*, Hawkesbury River c. 2 mi fr station on old rd (NSW7058) (4); *Blakely*, Hawkesbury to Cowan (NSW7056) (4); *Blakely*, Hornsby (NSW6990) (1); *Bond*, 6 mi SE Underbool (MEL) (1); *Boorman*, Boppy Mt nr Cobar (NSW7020) (3); *Boorman*, Forked Mt Coonabarabran (NSW7028) (2); *Boorman*, Gungal nr Merriwa (NSW7037) (1); *Boorman*, Howell (NSW6997) (2); *Boorman*, Jennings (NSW7002) (2); *Boorman*, Kurnell (NSW6983) (1); *Boorman*, L Cudgellico (NSW7023) (3); *Boorman*, Stanthorpe (NSW7004) (2); *Boorman*, Torrington (NSW6994) (2), *Boorman*, Wallangarra (NSW17306) (2); *Boorman*, Wyalong (NSW7016) (3); *Boorman*, nr Mt Hope (NSW7017) (3); *Brant*, Dimboola (NSW136224) (1); *Brass & White* 6 (BRI) (2); *Briggs* 2868 (NSW) (1); *Briggs*, 5 mi NW Bordertown (NSW136236) (1); *Briggs*, Warrumbungle ra Belougery Split (NSW34354) (2); *Briggs*, c. 8.5 mi NW Kulnura (NSW136213) (1); *Browne*, Rankins Springs (NSW136232) (2); *Brymer*, Hopetoun (NSW7043) (1); *Burbidge* 6790 (CANB, NSW) (1); *Burbidge* 6811 (CANB, NSW) (1); *Cadwell*, 1 mi W Kamarah (NSW136221) (3); *Cambage* 122 (NSW) (3); *Cambage* 2379 (NSW) (3); *Cambage* 423 (NSW) (3); *Cambage*, Bindook Yerranderie (CANB) (1); *Cambage*, Torrington (NSW6998) (2); *Cambage*, Wyalong (CANB) (3); *Cambage*, Wybong, Denman (NSW7038) (2); *Cambage*, Yerranderie (NSW7015) (1); *Camfield*, Kogarah (NSW6977) (1); *Camfield*, Maroubra Bay (NSW6987) (1); *Camfield*, Springwood (NSW7009) (1); *Cheel*, Engadine (NSW6992) (1); *Cheel*, Long Bay (NSW6982) (1); *Cheel*, Parkes dist (NSW7036) (1); *Cheel*, Randwick (NSW6984) (1);

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(1); *Phillips*, Betw Inglewood & Wedderburn (BRI) (1); *Phillips*, Flat Rock Grampians (BRI) (1); *Phillips*, Near Tarnagulla (AD) (1); *Phillips*, Pilliga scrub (AD) (2); *Priest* 10620 (NSW) (1); *Pryor*, Mt Tennent (AD) (1); *Pullen* 2417, 2418 (CANB, NSW) (1); *Reader*, "Hilly Mallee country" (MEL) (1); *Rodway* 492 (NSW) (1); *Rodway* 605 (HO) (1); *Rodway* 606 (HO) (1); *Rowan*, Pt Jackson (MEL) (1); *Rowlands*, Warracknabeal (MEL) (1); *Rupp*, Mulgoa (NSW6978) (1); *Salasoo* 3779 (NSW) (2); *Schodde* 3155 (AD, BRI, CANB, MEL, NSW) (1); *Sharrad* 1136 (AD) (1); *Shea S62 (BRI) (2); Sieber* 282 (MEL) (1); *Siemssen*, Pt Jackson (MEL) (1); *Stafford*, Merriwa (NSW7039) (1); *Stephenson*, Middle Harbour (NSW6981) (1); *Stevenson*, Miles (BRI) (2); *Stuart*, New England (MEL) (2); *Sullivan*, Mt Cole (MEL) (1); *Swain*, Pilliga forest (NSW7029) (2); *Symon* 10919 (ADW) (1); *Thorne* 24998 (BRI) (1); *Tindale*, 55 mi NW Grafton Gibraltar ra (NSW84088) (2); *Tucker*, Lachlan r (MEL) (3); *Turner*, Serviceton (MEL) (1); *Vanden Brock* 676 (NT) (2); *W——*, Wedderburn dist (NSW7049) (1); *Walpole*, Wallangarra (BRI) (2); *Walter*, Grampians (BRI) (1); *Walter*, Grampians (CANB) (1); *Webb*, Upper Kangaroobie (CANB) (1); *West* 2239 (AD) (1); *Whaite* 1042 (NSW) (2); *Whaite* 1496 (NSW) (1); *Whaite* 1590 (NSW) (1); *Whaite* 1600 (NSW) (1); *Whaite* 2307 (NSW) (3); *Whaite* 2525 (NSW) (3); *Whaite* 2728 (NSW) (3); *Williamson*, Ballarat (NSW7045) (1); *Willis*, SW summit Manna Mt nr W Wyalong (MEL) (3); *Willis*, Snowy R gorge E Butcher's Ridge (MEL) (1); *Wilson* 2027 (AD) (1); *Wilson* 2129 (AD) (1); *Wrigley*, 11 mi fr Halls Gap tow Horsham (BRI) (1); *Yapp* 3 (PERTH) (1).

The Drummond collection of Western Australian fungi at the Royal Botanic Gardens, Kew

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Abstract

Hilton, Roger N. The Drummond collection of Western Australian fungi at the Royal Botanic Gardens, Kew. Nuytsia 4(3): 333-357 (1983). The 158 specimens of fungi collected by James Drummond between about 1843 and 1846 are reconsidered in the light of modern knowledge. They are arranged in order of Drummond's collecting numbers. Up-to-date information is given on the current taxonomic status, revisions and geographical distribution of included species. The present list acts as a companion to Berkeley's Decades of Fungi 3-8 (Units 21-73), incorporating extra material from the Drummond/Hooker correspondence, and providing the index wanting in the original. Fifty-five species described as new from the Drummond collections are included, of which 12 are now regarded as synonyms.

Introduction

The Western Australian collection of fungi made by James Drummond is important because it represents one of the first from the Southern Hemisphere and one made at the time that M. J. Berkeley and Elias Fries were naming new species from all over the world. A contemporary collection from Western Australia, that of Ludwig Preiss, was determined by Elias Fries, however, the Preiss collection was smaller (some 40 numbers compared with 158 by Drummond), was published a year later, and only a single number appears to be extant (Hilton 1982), whereas most of the Drummond fungi survive in the Kew Herbarium.

James Drummond was collecting plants and fungi in Western Australia from the time of his arrival there in 1828 as a 44-year old migrant until his death in 1863 (Erickson 1969). Most of his extensive collections were of flowering plants but in the winter of 1843 he gathered together 300 cryptogams, numbers 100-300 being those that he recognised as fungi. Of the fungi, some 130 survived and the consignment was sent to Sir William Jackson Hooker at Kew, with the third collection of plants, dated August 1844. Hooker passed the fungi to the Rev. M. J. Berkeley (1803-89) for determination. Berkeley returned a portion of each number, and these became a part of the Herb. Hookerianum bequeathed to Kew in 1867. With the acquisition of Herb. Berkeleyanum in 1879, the Kew Herbarium came to hold many of the numbers in duplicate. Berkeley's determinations, with comments and quotations from Drummond's notes, were published in Decades of Fungi, 1844-56, brought together in 1969 as an A. R. Asher Reprint. Since 1845 most of the Drummond specimens have been the subject of re-examination by specialists, and the Western Australian fungus flora itself has become better known. Many of these specimens have been cited in a census of Western Australian larger fungi (Hilton 1982). All the Drummond specimens have been seen by the author in the Kew Herbarium except when specifically stated to the contrary. This list should be used in conjunction with Berkeley (1844-56), as only comments by Drummond additional to those recorded by Berkeley are given. To facilitate cross reference, the Decade and Unit number is cited at the beginning of the commentary on each specimen. Apart from Decade 1,

Units 1 and 5, six decades are involved, made up of Unit numbers 21-73, the remaining 7 units of the last decade being of fungi from North America. As explained by Berkeley (1844-56 p. 1), comment on a number of species is intercalated under various Unit numbers; this is indicated here by the prefix 'sub' before the number.

Of the 200 or so 'numbers' that Drummond collected, 73 deteriorated after collection but before despatch or became detached from their labels; these are here listed "not represented". A 'number' sometimes included more than one species. There were also unnumbered fungi, and three collected subsequent to the main collection. Fifty-five were described as new species, of which 12 have now been recognised as synonyms.

The taxonomic position for late 1980 is given under 'current name'. Whereas there will, no doubt, be further taxonomic revisions, it is unlikely that much more Drummond material will come to light.

List of Drummond collections

The list is arranged sequentially according to Drummond's collecting numbers. Where several species occur under one collecting number they are distinguished by a, b, c, d etc.

93. *Tremella foliacea* Fr., Syst. mycol. 2: 212 (1822); Decade 6/sub 54.
Current name: As above.
Notes: Collected by Drummond as a lichen. A common jelly fungus on wood.

100. *Agaricus (Pholiota) allantopus* Berk., Lond. J. Bot. 4: 45 (1845); Decade 3/27.
Current name: *Gymnopilus allantopus* (Berk.) Pegler (1965 p. 323).
Notes: Reported on by Pegler (1965 p. 323). It does not match the most common wood-attacking toadstool throughout the South West, which is allied to *Gymnopilus penetrans* (Fr. ex Fr.) Murrill, but it does belong to the same genus.

101-103. Not represented.

104. *Agaricus campestris* L. var. *maximus* Drummond in Berkeley; Decade 3/sub 29.
Current name: As above.
Notes: Drummond (1843) states that this is a large species, middle-sized specimens being 30 cm in diameter with stalks 5 cm thick, associated with Wandoo. The largest and most prolific mushrooms still come from the Wandoo belt.

105. *Agaricus campestris* L. var. *varius* Drummond in Berkeley; Decade 3/sub 29.
Current name: As above.
Notes: Drummond (1843) stated that this was associated with York Gum. Similar forms now appear throughout the metropolitan area, as well as eastwards to the York Gum country.

106. *Agaricus* (*Lepiota*) *rhizobolus* Berk., Lond. J. Bot. 4: 42 (1845); Decade 3/21.
Current name: *Lepiota rhizobola* (Berk.) Sacc., Syll. Fung. 5: 41 (1887).
Notes: The description corresponds with that of an *Amanita* of the form of *Amanita conico-bulbosa* Cleland. Drummond's remarks

under specimen No. 121 support this diagnosis, as does Berkeley's comparison with *Agaricus vittadinii*, now recognised as an *Amanita*. Absence of the type from Kew prevents confirmation.

107. *Agaricus (Volvaria) xanthocephalus* Berk., Lond. J. Bot. 4: 45 (1845); Decade 3/26.
Current name: *Amanita xanthocephala* (Berk.) Reid & Hilton, in Reid (1980 p. 65).
Notes: Drummond (1843) suggested that this was an *Amanita* when discussing specimen No. 121 (q.v.). This suggestion has been confirmed. It is the pan-Australian species usually called *Amanita pulchella* (Cooke & Massee) Gilbert (=*Amanita austro-pulchella* Reid).

108. *Agaricus excoriatus* Fr., Hymen. Eur. p. 30 (1874); Decade 3/sub 21.
Current name: *Lepiota excoriata* (Fr.) Kummer *fide* Aberdeen (1962).
Notes: Drummond (1843) stated that it was "allied to *campestris*". Aberdeen (1962 p. 132) found spore and fruit body size, but not scales on the cap, to be consistent with *Lepiota excoriata*. He suggested this name be retained temporarily for the W.A. specimens pending further clarification by comparison with fresh material.

109. *Agaricus (Pleurotus) lampas* Berk., Lond. J. Bot. 4: 44 (1845); Decade 1/1 and 3/25.
Current name: *Pleurotus nidiformis* (Berk.) Sacc., Syll. Fung. 5: 357 (1887).
Notes: In 1841 Drummond sent a specimen of this fungus to Berkeley, who gave it the name which has priority (Willis 1953 p. 33): *Pleurotus nidiformis*. This well-known luminous fungus has been re-collected many times and is also widespread in the eastern part of Australia.

110. "On the trunk, or parasitical on the roots, of the Native Gumback, a species of *Melaleuca*." Drummond (1843). This number is not in the Decades, nor was a corresponding specimen found in the Kew Herbarium. This could have been another collection of *Pleurotus nidiformis* (Berk.) Sacc., a species which is often found growing up from the surface roots of dying melaleucas.

111. *Paxillus eucalyptorum* Berk., Lond. J. Bot. 4: 49 (1845); Decade 4/31.
Current name: As above.
Notes: the colourless elongated spores described by Berkeley do not fit *Paxillus*, but no material survives for examination. A common species of *Paxillus* that Drummond would certainly have collected is *Paxillus muelleri* (Berk.) Sacc., but the sketch by Drummond on page 18 of his letter (Drummond 1843) shows a fungus too massive to be this. The size and colourless elongated spores would fit one of the *Lentinus* species common in the State.

112. *Cortinarius (Myxacium) erythraeus* Berk., Lond. J. Bot. 4: 48 (1845); Decade 3/30.
Current name: *Cortinarius erythraeus* Berk.
Notes: A small but distinctive red *Cortinarius*. This name predates *Cortinarius ruber* Cleland according to Moser & Horak (1975 p. 574). It has been re-collected a number of times in recent years.

113. *Agaricus (Tricholoma) muculentus* Berk., Lond. J. Bot. 4: 43 (1845); Decade 3/22.
Current name: *Tricholoma muculentum* (Berk.) Sacc., Syll. Fung. 5: 91 (1887).
Notes: No. 43 in the type description is a misreading of the number 113 written on the specimen. It was growing amongst moss, which is still to be found accompanying the type specimen.

114. *Cantharellus viscosus* Berk., Lond. J. Bot. 4: 49 (1845); Decade 4/32.
Current name: As above.
Notes: This name was accepted by Pegler (1965 p. 348) and Corner (1966 p. 59) as the result of their examination of the type material, but the fungus has not been re-collected.

115. *Agaricus gilvus* Fr., Hymen. Eur. p. 95 (1874); Decade 3/sub 22.
Current name: *Clitocybe gilva* (Fr.) Sacc., Syll. Fung. 5: 612 (1887).

116. *Agaricus (Naucoria) drummondii* Berk., Lond. J. Bot. 4: 46 (1845); Decade 3/28.
Current name: *Pholiota drummondii* (Berk.) Pegler (1965 p. 330).
Notes: Pegler (1965 p. 330) recombines it as a *Pholiota*; it is not the common wood-attacking toadstool close to *Pholiota highlandensis* (Peck) A. H. Smith & Hesler, and has not been re-collected.

117. Not represented.

118. *Bolbitius fragilis* Fr., Epicr. Syst. mycol. 254 (1838); Decade 3/sub 29.
Current name: *Bolbitius vitellinus* (Fr.) Fr., Epicr. Syst. mycol. p. 24 (1838).
Notes: *Bolbitius fragilis* is generally accepted as a synonym of *B. vitellinus* and the Kew specimen is consistent with this species.

119. *Agaricus radicatus* Fr. var. *superbiens* Berk., Lond. J. Bot. 4: 43 (1845); Decade 3/23.
Current name: *Oudemansiella radicata*, (Relhan ex Fr.) Singer, Ann. mycol. Berl. 34: 333 (1936).
Notes: Pegler (1965 p. 345) regards this taxon as one of the many varieties of this species, but does not accept the name *superbiens*.

120. Not represented.

121. "This species, 106, and 107, are allied to *Agaricus muscarius*. 121 has a volva at the root but is distinguished from 106 by its smaller root, it is much rarer here than 106. I think I remember it as a British species." (Drummond 1843). This might have been one of the amanitas similar to *Amanita vaginata*, but no material is extant to confirm this.

122. Not represented.

123. *Exidia glandulosa* Fr., Syst. mycol. 2: 224 (1822); Decade 6/sub 54.
Current name: As above.
Notes: The Kew specimen has not been found, nevertheless this is a cosmopolitan species that has been re-collected many times.

124. Not represented.

125. *Polyporus (Apus) portentosus* Berk., Lond. J. Bot. 3: 188 (1844); Decade 1/5.
Current name: *Piptoporus portentosus* (Berk.) G. H. Cunningham (1965 p. 106).
Notes: As No. 142. This is the familiar large bracket fungus which grows high up on jarrah, blackbutt, marri and flooded gum, in all of which it causes a brown rot of the timber. It is also well-known in the eastern parts of Australia.

126 and 127. Not represented.

128. *Agaricus nudus* Bull. ex Fr., Hymen. Eur. 72 (1874); Decade 3/sub 21.
Current name: *Lepista nuda* (Fr.) Cooke, Hand. Br. Fung. 1: 192 (1871).
Notes: "A beautiful sp. allied to *campestris*." Drummond (1843). However, the hyaline spores of the specimen at Kew do not confirm this alliance, but are consistent with the specimen being a large-spored variety of *Lepista nuda* (Fr.) Cooke. There is no other authenticated record from the State of this well-known species.

129. *Agaricus mollis* Fr., Syst. mycol. 1: 274 (1821): Decade 3/29.
Current name: *Crepidotus uber* (Berk. & Curt.) Sacc., Syll. Fung. 5: 878 (1887).
Notes: As No. 272a and 296. It has been equated with *Crepidotus uber* (Berk. & Curt.) Sacc. by Pilát (1950 p. 236).

130. *Polyporus (Resupinatus) tardus* Berk., Lond. J. Bot. 4: 56 (1845); Decade 5/43.
Current name: *Poria tarda* (Berk.) Cooke, Grevillea 14: 109 (1886).
Notes: Discussed by Ryvarden (1977 p. 226) and provisionally accepted by him as *Poria tarda* (Berk.) Cooke.

131. *Agaricus atrocaeruleus* Fr., Syst. mycol. 1: 190 (1821); Decade 3/sub 25.
Current name: *Hohenbuehelia atrocaerulea* (Fr.) Singer, Agaricales 255 (1949).

132. *Agaricus perpusillus* Fr., Syst. mycol. 1: 195 (1821); Decade 3/sub 25.
Current name: *Pleurotus perpusillus* (Fr.) Sacc., Syll. Fung. 5: 383 (1887).
Notes: In the absence of spores or any special structure on the specimen that would indicate otherwise, the name stands.

133. "A beautiful plant in which the gills are placed in pairs and when dry turn in opposite directions." Drummond (1843). Although the specimen did not survive to reach Berkeley, it was doubtless the same as specimen 280, *Schizophyllum commune* Fr.

134. *Lentinus fasciatus* Berk., Hook. J. Bot. 2: 146 (1840); Decade 4/sub 32.
Current name: *Panus fasciatus* (Berk.) Pegler, (1965 p. 331).
Notes: "Like the figure of *L. fasciatus* in Journal of Botany" Drummond (1843), who thereby identified it. Pegler (1965) recombined it as *Panus fasciatus*, under which name a number of new Western Australian collections were described in detail by Broughton & Hilton (1972).

135. *Polyporus (Apus) venustus* Berk., Lond. J. Bot. 4: 55 (1845); Decade 5/42.
Current name: *Trametes versatilis* Berk., Lond. J. Bot. 1: 150 (1842).
Notes: As Reid (1967) points out, this cannot be the same fungus as that described by Cunningham (1965 p. 97) under his new combination *Trichaptum venustum* (Berk.) G. H. Cunningham. Ryvarden (1977 p. 227) treats it as a synonym of *Trametes versatilis* under which he includes *Trichaptum byssogenum* (Jungh.) Ryvarden.

136. *Polyporus vaporarius* Fr., Syst. mycol. 1: 382 (1821); Decade 5/sub 43.
Current name: *Poria versipora* (Pers.) Romell, Svensk Botanisk Tidskrift 20: 15 (1962).
Notes: Cunningham (1965 p. 64) recognises it as being *Poria versipora* (Pers.) Romell.

137. *Polyporus vaporarius* Fr., Syst. mycol. 1: 382 (1821); Decade 5/sub 43.
Current name: *Poria* sp.
Notes: This is different from No. 136, but devoid of characters that would enable it to be identified as any particular species of *Poria*.

138. *Hydnum investiens* Berk., Lond. J. Bot. 4: 57 (1845); Decade 5/45.
Current name: As above.

139. "Beautiful purple when fresh, with a distinct white margin" Drummond (1843). This description would fit the cosmopolitan *Lopharia crassa* (Lév.) Boidin but no Drummond specimen is extant by which this diagnosis could be confirmed.

140. Not represented.

141. *Polyporus (Apus) compressus* Berk., Lond. J. Bot. 4: 53 (1845); Decade 6/39.
Current name: *Truncospora ochroleuca* (Berk.) Pilát in Atlas Champ. Eur. 3: 365 (1941).
Notes: With No. 248 and No. 285 is *Polyporus ochroleucus* Berk. (Ryvarden 1977 p. 218), placed in *Perenniporia* by Ryvarden.

142. *Polyporus (Apus) portentosus* (Berk.), Lond. J. Bot. 3: 188 (1844); Decade 4/sub 37.
Current name: *Piptoporus portentosus* (Berk.) G. H. Cunningham (1965 p. 106).
Notes: As Drummond No. 125.

143. *Polyporus igniarius* Fr., Syst. mycol. 1: 375 (1821); Decade 4/40.
Notes: It is doubtful whether this specimen, or No. 146, is the European species *P. igniarius* but, in the absence of an extant specimen, *Phellinus rimosus* (Berk.) Pilát could be suggested as the probable identity (see No. 144 and No. 146).

144. *Polyporus (Apus) rimosus* Berk., Lond. J. Bot. 4: 54 (1845); Decade 4/40.
Current name: *Phellinus rimosus* (Berk.) Pilát, Annales Mycologici 38: 80 (1940).
Notes: A species of wide distribution including the U.S.A.; see Cunningham (1965 p. 232) and Ryvarden (1977 p. 225).

145. *Trametes pini* Fr., Epicr. Syst. mycol. p. 489 (1838); Decade 5/43.
Notes: It is doubtful whether this is the Northern Hemisphere *T. pini*, which has never been collected in the State, but no specimen could be found.

146. *Polyporus igniarius* Fr., Syst. mycol. 1: 375 (1821); Decade 4/40.
Notes: Drummond (1843) "on *Manglesia drummondii*", a species of *Beaufortia*, a Bottle Brush. See comments under No. 143.

147. *Polyporus feei* Fr. */Polyporus lilacino-gilvus* Berk., Ann. nat. Hist. 3:324 (1839); Decade 5/sub 41.
Current name: *Trametes lilacino-gilva* (Berk.) Lloyd, Synopsis of the genus Fomes p. 226 (1915).
Notes: "Beautiful and very rare" Drummond (1843). The fungus is by no means rare in the coastal districts. *Polyporus feei* is a form of the same species.

148. *Polyporus cinnabarinus* Fr., Syst. mycol. 1: 371 (1821); Decade 5/41.
Current name: *Pycnoporus coccineus* (Fr.) Bond. & Singer, Ann. Mycol. 39: 59 (1941).
Notes: "Very common but very beautiful, supposed to be *cinnabarina*" Drummond (1843). Nobles & Frew (1962 p. 987) indicate *P. cinnabarinus* to be only Northern Hemisphere, and *P. coccineus* to be Southern Hemisphere temperate.

149a. *Polyporus gryphaeaeformis* Berk., Lond. J. Bot. 4: 54 (1845); Decade 5/41.
Current name: *Polyporus gryphaeiformis* Berk.
Notes: The current name is spelt '*gryphaeiformis*' in accordance with Recommendation 73 b 1 (a) (2) of the International Code of Botanical Nomenclature. Drummond (1843) comments "only one specimen seen and not recent." This specimen is now represented at Kew only by fragments. Saccardo, Syll. Fung. 6: 183 (1888), recombines as *Fomes griphaeformis* and Ryvarden (1977 p. 221) suggests a *Ganoderma* from the description. It is associated with *Hydnum isidioides*.

149b. *Hydnum isidioides* Berk., Lond. J. Bot. 4: 58 (1845); Decade 5/47.
Current name: *Sarcodontia isidioides* (Berk.) Reid (1965 p. 641).
Notes: On hymenium of *Polyporus gryphaeiformis*. Reid (1956 p. 641), puts it in the genus *Sarcodontia*.

150. *Polyporus (Apus) demissus* Berk., Lond. J. Bot. 4: 52 (1845); Decade 4/37.
Current name: *Bjerkandera fumosa* (Fr.) Karsten, Medd. Soc. Fauna Fl. Fenn. 5: 38 (1879).
Notes: The type, according to Ryvarden (1977 p. 219), represents *Bjerkandera fumosa*.

151. *Hexagonia decipiens* Berk., Lond. J. Bot. 4: 57 (1845); Decade 5/44.
Current name: *Phaeotrametes decipiens* (Berk.) Wright (1966 p. 532).
Notes: As 152. The specific epithet was lost when Cunningham placed it into *Trametes*, the epithet *decipiens* being preoccupied. He named it *Trametes drummondii*. Wright (1966) made it the type of the widespread Southern Hemisphere species *Phaeotrametes decipiens*. This is accepted by Ryvarden (1977 p. 215).

152. *Hexagonia decipiens* Berk., Lond. J. Bot. 4:57 (1845); Decade 5/44.
Current name: *Phaeotrametes decipiens* (Berk.) Wright.
Notes: As 151.

153. *Hexagonia gunnii* Berk., Ann. Nat. Hist. 7: 452 (1841); Decade 5/sub 44.
Current name: *Hexagonia vesparius* (Berk.) Ryvarden, Kew Bull. 31:83 (1976).
Notes: Ryvarden points out that *gunnii* was a superfluous epithet with which Berkeley had replaced *vesparius.*

154. *Polyporus varius* Fr., Syst. mycol. 1: 352 (1821); Decade 4/sub 36.
Notes: Drummond (1843) "this specimen is the only one found on the flooded gum". There is now no specimen at Kew, but Ryvarden (1978 p. 390) states that the species is widespread in the temperate region both in the Northern and Southern Hemisphere.

155. *Boletus marginatus* Drumm. ex Berk., Lond. J. Bot. 4: 50 (1845); Decade 4/33.
Current name: *Phaeogyroporus portentosus* (Berk. & Broome) McNabb, N.Z. J. Bot. 6: 142 (1968).
Notes: " . . . the *Boletus Marginatus* is nearly allied to the *Esculent* Boleti, five or six species of which are used as food by the natives . . ." Sketch on p. 20 annotated: "Pileus and stem black. Pores brown with a distinct margin by the projection of the cuticle" Drummond (1843). Spores of the Kew specimen measure 7-9 x 5-6.5 μm. The accompanying specimen in the folder at Kew is from Melbourne, dated 27/5/1889, and presumably the basis of McAlpine's 1895 record, is certainly not this species. Spore-size, colouration of specimen, and the sketch in Drummond's letter, all point to it being *Phaeogyroporus portentosus.*

156. *Boletus alliciens* Berk., Lond. J. Bot. 4: 50 (1845); Decade 4/34.
Current name: As above.
Notes: Drummond states that this was one of the species eaten by aborigines and went (with other species?) under the name "woorda". There is neither specimen nor catalogue number at Kew. The description is inadequate to equate it with any of the many boletes collected since.

157. *Polyporus (Mesopus) oblectans* Berk., Lond. J. Bot. 4: 51 (1845); Decade 4/35.
Current name: *Coltricia cinnamomea* (Pers.) Murrill, Bull. Torrey Bot. Cl. 31: 343 (1904).
Notes: As 220. Ryvarden (1977 p. 223) disagreed with Cunningham (1965 p. 191) and accepted this as the species *C. cinnamomea,* with which he was fully familiar from work with European collections.

158. *Stereum illudens* Berk., Lond. J. Bot. 4: 59 (1845); Decade 5/48.
Current name: *Xylobolus illudens* (Berk.) Boidin, Revue Mycol. 23: 341 (1958).
Notes: "Very common on all sorts of dead wood." Drummond (1843). It is also common in eastern Australia and in New Zealand. The species remains as *Stereum* in Cunningham (1963).

159. *Stereum hirsutum* Fr., Syst. mycol. 1: 439 (1821); Decade 5/sub 48.
Current name: As above.
Notes: "Of a beautiful golden yellow when fresh, very rare, seen only on one tree, perhaps a variety of 158" Drummond (1843). As part of No. 208.

160. *Corticium vinosum* Berk., Lond. J. Bot. 4: 60 (1845); Decade 6/51.
Current name: *Lopharia crassa* (Lév.) Boidin, Bull. trimest. Soc. mycol. Fr. 74: 479 (1958).
Notes: The type was filed at Kew under *Hymenochaete vinosum* (Berk.) Cooke. Cunningham (1963) takes it as synonymous with the cosmopolitan *Lopharia crassa.*

161. *Stereum rubiginosum* Fr., Syst. mycol. 1: 346 (1821); Decade 5/sub 48.
Current name: *Hymenochaete rubiginosa* (Fr.) Lév., Ann. Sci. Nat. Bot. Ser. 3, 5: 151 (1846).
Notes: "Rich brown velvet-like border, as far as I have observed always fixed" Drummond (1843).

162. *Corticium radicale* Berk., Lond. J. Bot. 4: 59 (1845); Decade 5/50.
Current name: *Steccherinum ochraceum* (Pers.) Gray, Nat. Arr. Br. Pl. 1: 651 (1821).
Notes: Cunningham (1963 p. 339) recognised the type specimen to be the widespread species *Steccherinum ochraceum.*

163. *Auricularia minuta* Berk., Lond. J. Bot. 4: 59 (1845); Decade 5/49.
Current name: As above.
Notes: As Lowy (1952 p. 686) suggests, this species is doubtfully an *Auricularia* but in the absence of spores on the specimen, and of re-collection, the name must stand.

164. Not represented.

165. *Corticium incarnatum* Fr., Epicr. Syst. mycol. p. 564 (1838); Decade 6/sub 51.
Current name: *Peniophora incarnata* (Fr.) Karsten, Hedwigia 28: 27 (1889).

166. *Mycenastrum phaeotrichum* Berk., Lond. J. Bot. 2: 518 (1843); Decade 6/60.
Current name: *Mycenastrum corium* (Guersent) Desvaux, Ann. Sci. Nat. II 17: 147 (1842).

167. *Bovista lilacina* Mont. & Berk., Lond. J. Bot. 4: 64 (1845); Decade 6/59.
Current name: *Calvatia lilacina* (Berk.) P. Henn., Hedwigia 43: 205 (1904).
Notes: Cunningham (1944) places as *Calvatia lilacina,* a widespread species which Dring (1964 p. 38) puts in *C. cyathiformis* ssp. *fragilis.*

168. *Scleroderma geaster* Fr., Syst. mycol. 3: 46 (1829); Decade 6/sub 60.
Notes: The Drummond specimen was not found at Kew, but in Cunningham (1944 p. 118) the only Australian record of this species is from W. Australia.

169. *Scleroderma vulgare* Fr., Syst. mycol. 3: 46 (1829); Decade 6/60.
Notes: *Scleroderma vulgare* is based on a mixed collection according to Cunningham (1944 p. 216) but there is no surviving specimen at Kew to decide the identity of Drummond's fungus.

170. *Polysaccum pisocarpium* Fr., Syst. mycol. 3: 54 (1829); Decade 6/sub 60.
Notes: A "curious *Lycoperdon* composed of many small globose or irregularly shaped bodies" Drummond, 1843. This would be *Pisolithus tinctorius*, but no specimen is extant.

171. *Polysaccum crassipes* DC. var. *australe* Lév., Fragm. Mycol. p. 136, together with *Polysaccum turgidum* Fr., Syst. mycol. 3: 53 (1829); Decade 6/60.
Notes: Drummond's (1843) comment on 170 applies to 171 as well. Both would be forms of *Pisolithus tinctorius,* but this cannot be confirmed in the absence of an extant specimen.

172. *Lycoperdon gemmatum* Fr., Syst. mycol. 3: 36 (1829); Decade 6/sub 60.
Notes: As No. 250. Specimen No. 172 was not found in Kew Herbarium; the species *L. gemmatum* is classified there as *Lycoperdon pusillum* Pers.

173. *Geaster striatus* DC., Fl. fr. 2, p. 267 (1815); Decade 6/sub 57.
Current name: *Geastrum pectinatum* Pers., Synop. method. Fung. p. 132 (1801).
Notes: "A large 3-coated species of the curious star-like fungus I sent you in the box by the Houghton Le Skerne." Drummond (1843), referring to an earlier shipment of fungi. *Geastrum striatum* (DC.) Fr. = *G. pectinatum* Pers. following Cunningham (1944 p. 162).

174. *Geaster rufescens* Pers., Synopsis Fung. 134 (1801); Decade 6/sub 58.
Current name: *Geastrum simulans* Lloyd p. 17 (1905).
Notes: "A species of the same genus (as 173) without teeth" Drummond (1843). Discussed by Lloyd (*op. cit.*) and made the type of a new species.

175. *Geaster minimus* Schwein., Schrift. Naturf. Ges. Leipzig 1: 166 (1822); Decade 6/57.
Current name: *Geastrum minimum* Schwein.
Notes: A cosmopolitan species described by Dring (1964 p. 26).

176. *Clathrus pusillus* Berk., Lond. J. Bot. 4: 67 (1845); Decade 7/65.
Current name: As above.
Notes: Cunningham (1944) reports from other Australian States, Dring & Rose (1977 p. 747), from W. Africa.

177. *Ileodictyon gracile* Berk., Lond. J. Bot. 4: 69 (1845); Decade 7/66.
Current Name: As above.
Notes: Cunningham (1944 p. 111) names as *Clathrus gracilis* (Berk.) Schlechtendal. Dring & Rose (1977 p. 748) report from places on the Atlantic coasts of Europe and Africa; they retain the name *Ileodictyon gracile* Berk.

178. *Phallus curtus* Berk., Lond. J. Bot. 4: 69 (1845); Decade 7/67.
Current name: *Mutinus curtus* (Berk.) Fischer, Syll. Fung. 7: 13 (1888).
Notes: Cunningham (1944 p. 91) records it as occurring elsewhere in Australia. No. 272c is another collection.

179. *Tulostoma fimbriatum* Fr., Syst. mycol. 3: 43 (1829); Decade 6/sub 60.
Current name: *Tulostoma australianum* Lloyd ex G. H. Cunningham, Proc. Linn. Soc. N.S.W. 50: 256 (1925).
Notes: Cunningham (1944 p. 216) considered the record might have been of *T. obesum*, but had not seen the specimen. Dring had annotated the specimen sheet at Kew: *Tulostoma australianum* Lloyd ex. G. H. Cunningham.

180. *Secotium melanosporum* Berk., Lond. J. Bot. 4: 62 (1845); Decade 6/56.
Current name: *Endoptychum melanosporum* (Berk.) Singer & Smith, Brittonia 10: 220 (1958).
Notes: Cunningham (1944 p. 83) accepts as a good species and records in addition for S. Australia and N.S.W.

181. *Secotium coarctatum* Berk., Lond. J. Bot. 4: 63 (1845); Decade 6/57.
Current name: As above.
Notes: "It has a very strong peculiar smell which it loses when dry" Drummond (1843). Cunningham (1944 p. 82) records for S. Australia, N.S.W., and Tasmania, and accepts it as *Secotium*.

182. *Mitremyces luridus* Berk., Lond. J. Bot. 4:182 (1845); Decade 7/61.
Current name: *Calostoma luridum* (Berk.) Massee, Ann. Bot. 2: 43 (1888).
Notes: "A curious little plant; I scarcely know whether it belongs to fungi, or lichenes. It grows on sand and appears like a *Tremella* or gelatinous lichen . . ." Drummond (1843). Drummond's comment draws attenton to the gelatinous base. Cunningham (1944 p. 114) equates it with *C. fuscum*, but 182 is a smaller species, with smaller spores and no red peristome, so the name accepted by Massee should stand.

183. *Peziza drummondii* Berk., Lond. J. Bot. 4: 71 (1845); Decade 7/69.
Current name: As above.
Notes: Rifai (1968 p. 277) suggests that this may have to be made the type species of a new genus in the Sarcoscyphaceae when freshly collected specimens become available to supplement the inadequate existing material.

184. Not represented.

185. *Sphaeria rosella* Albertini & Schweinitz, Cons. Fung. p. 38 (1805); Decade 8/sub 71.
Current name: *Hypomyces rosellus* (Alb. & Schw.) Tulasne, Sel. Fung. Carpol. 3: 45 (1865).
Notes: The specimen at Kew now shows little more than the wine red mycelium on a substratum of charcoal.

186. *Peziza applanata* Fr., Syst. mycol. 2: 64 (1822); Decade 7/sub 69.
Notes: Rifai (1968) does not mention this species and the voucher specimen could not be found at Kew.

187. *Sphaeria punctata* Fr., Syst. mycol. 2: 330 (1823); Decade 7/sub 69.
Current name: *Poronia punctata* (Fr.) Fr., Summa veg. Scand. 382 (1849).
Notes: This is a distinctive fungus on Kangaroo (and other) dung.

188. *Licea applanata* Berk., Lond. J. Bot. 4: 67 (1845); Decade 7/64.
Current name: *Dictydiaethalium plumbeum* (Schum.) Rost., in Lister, Mycetozoa p. 197 (1894).
Notes: Martin & Alexopoulos (1969 p. 60) cite as this cosmopolitan species.

189. *Peziza melaloma* Alb. & Schw. ex Fr., Syst. mycol. 2: 68 (1822); Decade 7/sub 69.
Current name: *Antracobia melaloma* (Fr.) Boudier, Host. Class. Discom. d'Europe p. 65 (1907).
Notes: Rifai (1968 p. 142) states that the identity cannot be confirmed because of the absence of colour annotation.

190. *Peziza rutilans* Fr., Syst. mycol. 2: 68 (1822); Decade 7/sub 69.
Current name:*Leocoscypha rutilans* (Fr.) Dennis & Rifai in Rifai p. 164 (1968).
Notes: Rifai (1968 p. 165) comments that there are now no apothecia, but that the specimen is probably a *Leucoscypha.*

191. Not represented.

192. *Antennaria scoriadea* Berk. ined.; Decade 7/sub 68.
Current name: *Capnodium scoriadeum* (Berk.) v. Höhnel, Sitzung. keiserl. Akad. Wiss. Wien 118: 32 (1909).
Notes: The name was subsequently published by Berkeley, based on a specimen from Auckland Is., in Hooker's Flora Antarctica 1:175 (1847). The type is to be found at Kew, but not Drummond No. 192 (which was associated with *Fusarium lateritium).*

193. *Tremella mesenterica* Fr., Syst. mycol. 2: 214 (1822); Decade 6/sub 54.
Current name: As above.
Notes: The original record for Western Australia of this common species.

194. *Exidia glandulosa* Fr., Syst. mycol. 2: 224 (1822); Decade 6/54.
Current name: As above.
Notes: As part of No. 123, but neither number was found at Kew; a cosmopolitan and frequently collected species.

195 and 196. Not represented.

197. *Clavaria botrytis* Pers. ex Fr., Syst. mycol. 1: 466 (1821); Decade 6/sub 53.
Current name; *Ramaria botrytoides* (Peck) Corner, Ann. Bot. Memoirs 1: 562 (1950).

198. *Clavaria,* disposed at Kew as *Clavaria botrytis,* hence *Ramaria botrytoides* (Peck) Corner—see No. 197.

199. *Clavaria setulosa* Berk., Lond. J. Bot. 4: 61 (1845); Decade 6/53.
Current name: *Clavulina setulosa* (Berk.) Corner, Beihefte Nova Hedwigia No. 33 (1970).
Notes: Corner (1950 p. 716) gives as *Lachnocladium setulosum* (Berk.) Lév., as in Saccardo, Syll. Fung. 6: 740, a species still only known from this one Western Australian collection.

200. *Thelephora caryophyllaea* Fr., Syst. mycol. 1: 430 (1821); Decade 5/47.
Current name: *Thelephora terrestris* Fr., Syst. mycol. 1: 431 (1821).
Notes: Cunningham (1963 p. 229) points out that *T. caryophyllaea* is a form name for *T. terrestris.* This therefore becomes the original record for Western Australia of the common species *Thelephora terrestris* Fr.

201. *Sphaeria rubricosa* Fr., Elench. fung. 2: 63 (1828); Decade 7/69.
Current name: *Valsaria rubricosa* (Fr.) Sacc., Syll. Fung. 1: 743 (1882).

202. *Lycogala epidendrum* Fr., Syst. mycol. 3: 80 (1829); Decade 7/sub 61.
Current name: As above.
Notes: A cosmopolitan species.

203. Not represented.

204. *Calocera guepiniodes* Berk., Lond. J. Bot. 4: 61 (1845); Decade 6/54.
Current name: As above.
Notes: McNabb (1965a p. 38) stated that it appears to be confined to Australia and New Zealand.

205. *Guepinia pezizaeformis* Berk., Lond. J. Bot. 4: 60 (1845); Decade 6/5.
Current name: *Heterotextus peziziformis* (Berk.) Lloyd, Mycol. Notes 67: 1149.
Notes: Since found elsewhere in Australia, New Zealand and Argentina. McNabb (1965b p. 219) accepted this as a good species.

206. Not represented.

207. *Hydnum dispersum* Berk., Lond. J. Bot. 4: 58 (1845); Decade 5/46.
Current name: As above.
Notes: There has been no further record, or revision, of this species.

208a. *Stereum hirsutum* (Willd.) Pers. ex Gray, Nat. Arr. Br. Pl. 1: 652 (1821); Decade 5/sub 48.
Current name: As above.
Notes: As No. 159.

208b. *Physarum flavicomum* Berk., Lond. J. Bot. 4: 66 (1845), Decade 7/63.
Current name: As above.
Notes: Martin & Alexopoulos (1969 p. 301) accept the species, although citing the type locality, in error, as New South Wales.

209. *Stemonitis fusca* Roth, Mag. Bot. Römer & Usteri 1 (2): 26 (1787); Decade 7/sub 63.
Current name: As above.
Notes: As No. 272 in part. A cosmopolitan species.

210. *Peziza cochleata* Fr. form; Decade 7/sub 69.
Notes: Rifai (1968 p. 224) says that the true identity of *P. cochleata* is open to question. He does not mention the Drummond specimen.

211. Not represented.

212a. *Dacrymyces rubro-fuscus* Berk., Lond. J. Bot. 4: 61 (1845); Decade 6/55.
Current name: *Sirobasidium sanguineum* Lagerh. & Pat., J. Bot., Paris 6: 467 (1892).
Notes: As No. 225 in part. McNabb (1973) refers to the type as being immature but appearing typical of *Sirobasidium sanguineum* Lagerh. & Pat.

212b. *Trichoderma viride* Pers. ex Fr., Syst. mycol. 3: 215 (1829); Decade 7/sub 67.
Current name: As above.
Notes: A universal soil mould.

212c. *Sphaeria β media* Pers. ex Fr., Syst. mycol. 2: 470 (1823); Decade 8/sub 72.
Notes: The specimen is not extant for examination.

212d. *Sphaeria inspersa* Berk., Lond. J. Bot. 4: 299 (1845); Decade 8/73.
Current name: *Rosellinia inspersa* (Berk.) Sacc., Syll. Fung. 1: 265 (1882).

213 and 214. Not represented.

215. *Excipula strigosa* Fr., Syst. mycol. 2: 103 (1822); Decade 7/sub 67.
Current name: *Dinemasporium strigosum* (Fr.) Sacc., Syll. Fung. 3: 683.

216 and 217. Not represented.

218. *Sphaeria (Lignosae) capnodes* Berk., Lond. J. Bot. 4: 72 (1845); Decade 7/70.
Current name: *Hypoxylon serpens* (Pers.) Fr., Summ. Veg. Scand. p. 384 (1846).
Notes: Listed in Miller (1961 p. 277).

219. Not represented.

220. *Polyporus (Mesopus) cladonia* Berk., Lond. J. Bot. 4: 51 (1845); Decade 4/36.
Current name: *Coltricia cinnamomea* (Pers.) Murrill.
Notes: As 157. As determined by Ryvarden (1977 p. 218) from the Kew specimen.

221. *Agaricus (Mycena) crinalis* Berk., Lond. J. Bot. 4: 44 (1845); Decade 3/24.
Current name: As above.
Notes: This remains a species neither re-classified nor recorded again.

222 and 223. Not represented.

224. *Agaricus applicatus* Batsch. ex Fr., Hymen. Eur. p. 180 (1874); Decade 3/sub 25.
Current name: *Resupinatus applicatus* (Batsch. ex Fr.) S. F. Gray, Nat. Arr. Br. Pl. 1: 617 (1821).
Notes: The same species as No. 286.

225a. *Dacrymyces rubro-fuscus* Berk., London. J. Bot. 4: 61 (1845); Decade 6/55.
Current name: *Sirobasidium sanguineum* Lagerh. & Pat.
Notes: As 212a.

225b. *Sepedonium chrysospermum* Link. ex Fr., Syst. mycol. 3: 438 (1832); Decade 7/67.
Current name: As above.
Notes: A common parasite of Boletaceae.

225c. *Sphaeria multiformis* Fr., Syst. mycol. 2: 334 (1823); Decade 7/sub 69.
Current name: *Hypoxylon multiforme* (Fr.) Fr., Summ. veg. Scand. p. 384 (1846).
Notes: This is recognised as a good species in Miller (1961).

225d. *Sphaeria elevata* Berk., Lond. J. Bot. 4: 298 (1845); Decade 8/71.
Current name: *Cryptovalsa elevata* (Berk.) Sacc., Syll. Fung. 1: 191 (1882).
Notes: This is listed in Saccardo with type locality in error as Tasmania.

225e. *Sphaeria pulvinulus* Berk., Lond. J. Bot. 4: 299 (1845); Decade 8/72.
Current name: *Pleosphaeria pulvinulus* (Berk.) Sacc., Syll. Fung. 2: 305 (1883).
Notes: With *Sphaeria sanguinea* Sibth. Not found at Kew.

225f. *Hysterium elongatum* Wahlenberg ex Fr., Syst. mycol. 2: 581 (1822); Decade 8/sub 73.
Current name: *Hysterographium elongatum* (Fr.) Corda, Icon. fung. I p. 77 (1837).
Notes: Zogg (1943 p. 310) recognises this as a valid species.

226. Not represented at Kew. "Found by the sides of pools of water, it has branches and perhaps roots like a conferta . . . I do not know natural order; something in common with 176." Drummond (1843).

227. Not represented.

228. *Cyathus vernicosus* DC., Fl. fr. 2, p. 270 (1815); Decade 7/sub 64.
Current name: *Cyathus olla* Pers., Syn. meth. Fung. 237 (1801).
Notes: Cunningham (1944 p. 206), gives the synonymy with *Cyathus olla* Pers.

229. *Agaricus lanuginosus* Fr., Syst. mycol. 1: 257 (1821) (*non* Bull.); Decade 3/sub 27.
Current name: *Inocybe lanuginosa* (Fr.) Sacc., Syll. Fung. 5: 765 (1887).

230-246. Not represented.

247. *Polyporus gilvus* Schwein. ex Fr., Elench. fung. 1: 104 (1828); Decade 4/36.
Current name: *Phellinus gilvus* (Schwein. ex Fr.) Pat., Essai Hymén. p. 97 (1900).
Notes: Cunningham (1950 p. 227) did not find the Drummond specimen at Kew and it appears to be missing. As No. 278, a cosmopolitan species.

248. *Polyporus (Apus) ochroleucus* Berk., Lond. J. Bot. 4: 53 (1845); Decade 4/38.
Current name: *Truncospora ochroleuca* (Berk.) Pilát.
Notes: As for No. 285 and No. 141.

249. *Merulius corium* Fr., Elench. fung. 1: 58 (1828); Decade 5/44.
Current name: As above.
Notes: The same species as No. 253.

250. *Lycoperdon gemmatum* Fr., Syst. mycol. 3: 36 (1829); Decade 6/60.
Notes: Not found at Kew but the species *L. gemmatum* is classified there as *Lycoperdon pusillum* Pers., as No. 172.

251. Not represented.

252. Not represented at Kew "So rare to the east of the Darling range: I find is not uncommon on *Eucalyptus occidentalis* near Perth" Drummond (1843). *Eucalyptus occidentalis* is the flat-topped Yate, and clearly the reference is to a wood-attacking fungus.

253. *Merulius corium* Fr., Elench. fung. 1: 58 (1828).
Current name: As above.
Notes: The same species as No. 249.

254-258. Not represented.

259. *Craterium pedunculatum* Trent. in Roth, Catalecta Bot. 1: 224 (1797); Decade 7/63.
Current name: *Craterium minutum* (Leers) Fr., Syst. mycol. 3: 151 (1829).
Notes: Martin & Alexopoulos (1969 p. 272) cite a wide distribution and equate with *Craterium minutum* (Leers) Fr.

260 and 261. Not represented.

262. *Myriangium montagnei* Berk., Lond. J. Bot. 4: 73 (1845).
Current name: As above.
Notes: A different species from the worldwide scale insect parasite *M. duriaei* Mont. & Berk., which was supposedly collected by Drummond at the same time. Both Drummond's collections, and subsequent collections elsewhere in Australia and New Zealand are *Myriangium montagnei* Berk., *vide* Petch (1924 p. 45).

263. *Didymium scrobiculatum* Berk., Lond. J. Bot. 4: 66 (1845); Decade 7/62.
Current name: *Physarum cinereum* (Batsch.) Pers., Neues Mag. Bot. 1: 89 (1794).
Notes: "Appears to be a species of (? *Zygodon*) different from the common sort" Drummond (1843). Martin & Alexopoulos (1969 p. 291) equate it with the cosmopolitan species *Physarum cinereum*.

264-268. Not represented.

269. *Merulius lacrymans* Fr., Syst. mycol. 1: 328 (1821); Decade 5/44.
Current name: *Serpula lacrymans* Gray, Nat. Arr. Br. Pl. 1: 637 (1821).
Notes: On decayed wood. The fungus has not subsequently been recorded from W. Australia, even as a cause of Dry Rot in buildings. The Kew specimen is not inconsistent with the forest species *Serpula himantioides* (Fr.) G. Cunn.

270. *Mystrosporium pulchrum* Berk. & Corda, Lond. J. Bot. 4: 70 (1845); Decade 7/68.
Current name: *Helicorhoidion pulchrum* (Berk. & Corda) Hughes, Canad. J. Bot. 36: 773 (1958).
Notes: Illustrated by Ellis (1971 p. 217).

271. Not represented.

272a. *Agaricus mollis* Fr.; Decade 3/29.
Current name: *Crepidotus uber* (Berk. & Curt.) Sacc.
Notes: As No. 129.

272b. *Stemonitis fusca* Roth; Decade 7/sub 63.
Current name: As above.
Notes: As No. 209.

272c. *Phallus curtus* Berk., Lond. J. Bot. 4: 69 (1845).
Current name: *Mutinus curtus* (Berk.) Fischer.
Notes: Preserved at Kew with the type (No. 178).
Possibly an error for 273 or other missing number.

273-277. Not represented.

278. *Polyporus gilvus* Schwein. ex Fr., Elench. fung. 1: 104 (1828); Decade 4/36.
Current name: *Phellinus gilvus* (Schwein. ex Fr.) Pat.
Notes: Cunningham did not find the specimen at Kew and it appears to be missing. As No. 247, a cosmopolitan species.

279. Not represented.

280. *Schizophyllum commune* Fr., Syst. mycol. 1: 330 (1821); Decade 4/sub 32.
Current name: As above.
Notes: Specimen 133 was doubtless the same species.

281. *Stereum purpureum* Fr., Epicr. Syst. mycol. p. 548 (1838); Decade 5/sub 48.
Current name: *Chondrostereum purpureum* (Fr.) Pouzar, Ceska Mykol. 13: 18 (1959).
Notes: This remains the only record for the State of the fungus *Chondrostereum purpureum* (Fr.) Pouzar, but the Drummond specimen at Kew could not be located for verification.
A disease with which this fungus is associated, Silver Leaf Disease of plum, has not been recorded in Western Australia.

282a. *Physarum flavicomum* Berk.
Current name: As above.
Notes: As No. 208, the type.

282b. *Physarum nutans* Pers., Am. Bot. Usteri 15: 6 (1795); Decade 7/sub 62.
Current name: As above.
Notes: Not found at Kew.

282c. *Arcyria incarnata* (Pers.) Pers., Observationes mycol. 1: 58 (1796); Decade 7/sub 63.
Current name: As above.

283. *Polyporus isidioides* Berk., Lond. J. Bot. 2: 515 (1843); Decade 4/36.
Current name: As above.
Notes: "Very nearly allied to 247 but the border is thicker and the fungus distinctly zoned" Drummond (1843). The specimen was found neither during the present study nor by Cunningham (1950).

284. "Also (with 283) a nearly allied species (to 247) but apparently distinct" Drummond (1843). No specimen reached Kew.

285. *Polyporus (Apus) ochroleucus* Berk., Lond. J. Bot. 4: 53 (1845); Decade 4/38.
Current name: *Truncospora ochroleuca* (Berk.) Pilát.
Notes: As No. 248 and No. 141.

286. *Agaricus applicatus* Batsch. ex Fr., Hymen. Eur. 180 (1874); Decade 3/sub 25.
Current name: *Resupinatus applicatus* (Batsch. ex Fr.) S. F. Gray.
Notes: The same species as No. 224.

287-295. Not represented.

296. *Agaricus mollis* Fr.; Decade 3/sub 29.
Current name: *Crepidotus uber* (Berk. & Curt.) Sacc.
Notes: As No. 129 and No. 272a.

297. Not represented.

298. "Appears to be the same as 158" Drummond (1843). It is likely to have been therefore another collection of *Stereum illudens* Berk., but no specimen exists by which this could be confirmed.

299. *Agaricus (Crepidotus) lepton* Berk., Lond. J. Bot. 4: 46 (1845); Decade 3/29.
Current name: *Crepidotus lepton* (Berk.) Sacc., Syll. Fung. 5: 885 (1887).
Notes: Accepted by Pilát (1950 p. 226), and Pegler (1965 p. 338) despite his finding the spores to be smaller than those quoted. There have been no further records.

300. "A curious plumose little plant which grows among a brown conferva-like substance on limestone rocks near Perth" Drummond (1843). No specimen survived to reach Kew.

s.n. *Agaricus fibula* Fr., Syst. mycol. 1: 163 (1821); Decade 3/sub 24.
Current name: *Mycena fibula* (Fr.) Kühner, Encyc. Myc. 10: 607 (1938).
Notes: Once put in *Omphalia*, now *Mycena*.

s.n. *Agaricus chioneus* Pers. ex Fr., Hymen. Eur. p. 81 (1874); Decade 3/sub 25.
Current name: *Pleurotellus chioneus* (Fr.) Kühner, Botaniste 17: 114 (1926).
Notes: The Kew specimen is well preserved and is on a piece of cattle dung.

s.n. *Polyporus ferruginosus* Fr., Syst. mycol. 1: 378 (1821); Decade 5/sub 42.
Current name: *Phellinus ferruginosus* (Fr.) Pat., Essai taxon. p. 97 (1900).
Notes: Cunningham (1965 p. 215) puts under *Fuscoporia punctata*, but Ryvarden (1978 p. 337) follows Patouillard in recombining as the European species *Phellinus ferruginosus*.

s.n. *Corticium incarnatum* Fr., Epicr. Syst. mycol. p. 564 (1838); Decade 6/sub 51.
Current name: *Peniophora incarnata* (Fr.) Karsten.
Notes: As No. 165.

s.n. *Corticium comedens* Fr., Epicr. Syst. mycol. 565 (1838); Decade 6/sub 51.
Current name: *Vuilleminia comedens* (Nees ex Fr.) Maire, Bull. Soc. Myc. Fr. 18 supp. p. 81 (1902).
Notes: In Kew as *Thelephora comedens* Nees.

s.n. *Secotium*, third species after No. 180 and No. 181; Decade 6/sub 57.
Current name: *Endoptychum agaricoides* Czerniaiev, Bull. Soc. Imp. Nat. Moscow 18: 148 (1845).
Notes: *Secotium agaricoides* was subsequently collected by Drummond (see below) and is a common species, but this specimen appears not to have been lodged in the herbarium of either Berkeley or Hooker. Berkeley's reference to "a great delicacy for the table" and to *Secotium gueinzii*, support the diagnosis of *Secotium agaricoides*, which is edible when young. The same reference also occurs at the end of Decade Unit 29. It is now placed as *Endoptychum agaricoides* Czern.

s.n. *Hymenogaster* fragment.
Notes: *Hymenogaster* spp. and species of allied genera are now common in W. Australia, but it is impossible to match them as this fragment appears not to have been preserved.

s.n. *Geaster drummondii* Berk., Lond. J. Bot. 4: 63 (1845); Decade 6/58.
Current name: *Geastrum drummondii* Berk.
Notes: This species has been collected in Africa and other parts of Australia since the original description, and a modern description is in Dring (1964 p. 25). *Geastrum* is the modern orthographic variant of *Geaster*.

s.n. *Polysaccum crassipes* DC. & Desp., Rapp. bot. Fr. 1: 8 (1807).
Current name: *Pisolithus tinctorius* (Mich. ex Pers.) Coker & Couch.
Notes: As 171, the same as, and accompanied by, *Pisolithus tinctorius* (Mich. ex Pers.) Coker & Couch.

s.n. *Stilbum erythrocephalum* Fr., Syst. mycol. 3: 302 (1832); Decade 7/sub 67.
Current name: *Stilbella erythrocephala* (Fr.) Lindau, Nat. Pflanzenfam. 1/1: 489 (1900).
Notes: Specimen not found at Kew. A common fungus on dung, now placed in the genus *Stilbella.*

s.n. *Peziza scutellata* L. ex St.A., Fries, Syst. mycol. 2: 85 (1822); Decade 7/sub 69.
Current name: *Scutellinia scutellata* (L. ex St.A.) Lambotte, Fl. mycol. Belg. Suppl. 1: 299 (1887).
Notes: A distinctive species, frequently collected. The Swan River collection at Kew lacks data (Rifai 1968 p. 116), but matches Drummond's labels.

s.n. *Ascobolus furfuraceus* Fr., Syst. mycol. 2: 163 (1823); Decade 7/sub 69.
Current name: As above.
Notes: Rifai (1968 p. 266) reports it on cow dung from Swan River *sine dat.* Drummond.

s.n. *Myriangium duriaei* Mont. & Berk., Lond. J. Bot. 4: 73 (1845); Decade 7 supplement.
Current name: *Myriangium montagnei* Berk.
Notes: Distinct from *Myriangium montagnei* Berk., No. 262, according to Berkeley but Petch (1924 p. 45) nominates the French specimen as the lectotype of *M. duriaei.* It is different from the Swan River specimen which is, in fact, *M. montagnei.*

Specimens sent subsequent to the main collection

Drummond, in an undated note, the script and paper of which match his letter to Hooker of 3rd May, 1848, refers to a consignment of fungi that could not be sent because most had been destroyed by white ants. The surviving specimens must have gone in the next (5th) consignment of plants sent in July 1849 (Erickson 1969 p 168).

Secotium drummondii Berk. *ined.* No. 32.

Current name: *Endoptychum agaricoides* Czern., Bull. Soc. Imp. Nat. Moscow 18: 148 (1845).

Notes: The specimen is accompanied by a note in Drummond's handwriting: "this fungus resembles in structure *Secotium Coarctatum* and the species I have marked in the box *Secotium Minutulum* but it differs from these in having the pileus permanently attached to the stem the seeds make their escape by the pileus dividing into filaments but the structure of these 3 species when recent is botryoidal not in pores or cells as in *Secotium Melanospermum".*

This is the type of the doubtful species *Chainoderma drummondii* Massee, Grevillea 19: 46 (1890). In the type description Massee compares his new genus *Chainoderma* with *Podaxis.* This led Morse, in Mycologia 25: 25 (1933), to equate *Chainoderma drummondii* with depauperate *Podaxis* forms from Colorado. Cunningham (1944 p. 198) examined the type at Kew and came to a similar conclusion: that it was a form of *Podaxis pistillaris.* However, a re-examination of the type made in the course of the present study showed the spores to be unlike *Podaxis* and to correspond with those of *Endoptychum agaricoides.* Support for this diagnosis comes from the presence in the *Endoptychum* folder of a specimen labelled Swan River No. 32, 1849, identical with the type specimen of *Chainoderma drummondii.*

One can conclude that No. 32 is *Endoptychum agaricoides* Czern.

Secotium coarctatum is Drummond 181, *Secotium melanosporum* is Drummond 180, but nothing relating to the *Secotium minutulum* has been found.

Agaricus (Acetabularia) cycnopotamia Berk., J. Linn. Soc. 18: 389 (1881).
Current name: *Volvariella cycnopotamia* (Berk.) Pegler (1965 p. 329).
Notes: Pegler (*op. cit.*) comments that this species of *Volvariella* has pink, subglobose spores 5.5-8 by 4.7-6.5 μm. These are much smaller than the 13-18 by 8-10.5 μm of the common *V. speciosa var. gloiocephala*, with which one might have been tempted to equate this species. The species is much closer to the European *V. loveiana* and there could be significance in the intimate association between *V. cycnopotamia* and the *Arachnion* with which it was collected.

Arachnion drummondii Berk., J. Linn. Soc. 18: 389 (1881).
Current name: As above.
Notes: Cunningham (1944 p. 209) comments that the type is too fragmentary for determination, but Demoulin (on the specimen, 1970) accepts it as a good species with spores rounder, bigger (4.8-4.9-5 μm) and glebal membranes not so well formed as in *A. album*.

Acknowledgements

The Director and Staff of the Royal Botanic Gardens, Kew, are thanked for providing study facilities during the last five months of 1979. Especially Dr D. A. Reid, under whose care the Drummond species are held and Miss E. Smith, archives section, who was so helpful in extracting and interpreting the J. Drummond—W. J. Hooker correspondence.

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The genus *Ondinea* (Nymphaeaceae) including a new subspecies from the Kimberley region, Western Australia

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Abstract

Kenneally, Kevin F. and Schneider, Edward L. The genus *Ondinea* (Nymphaeaceae) including a new Subspecies from the Kimberley region, Western Australia. Nuytsia 4 (3): 359-365 (1983). A new subspecies, *Ondinea purpurea* Hartog subsp. *petaloidea* is described and illustrated. The occurrence of previously unreported petaloid flowers in the genus and the discovery of seedlings necessitates expanding the species description. The gradation from sepals to petals to petaloid stamens to conventional stamens provides additional morphological data to support the placement of *Ondinea* in the Nymphaeaceae *sensu stricto*.

Introduction

Ondinea purpurea is a poorly known dicotyledonous aquatic perennial restricted to sandstone streams of the northern Kimberley region (Gardner District, Northern Botanical Province; Beard 1980) of Western Australia. The first collection of the plant was made by C. A. Gardner from the Prince Regent River system during his 1921 Kimberley Expedition. Subsequent collections which extended the known range were made by Leutert from near Kalumburu Mission (den Hartog 1970) and Hnatiuk and Kenneally (1981) from tributaries of the Mitchell River. This monotypic genus was described by den Hartog (1970) who considered *Ondinea* to be similar to *Nymphaea,* differing primarily in the absence of an aril, carpellary appendages (styles), a corolla and a stigmatic cup, and the presence of a conspicuously extended floral axis. Schneider and Ford (1978) examined the seed anatomy and morphology of *O. purpurea* and provided additional data to support den Hartog's alignment of *Ondinea* with *Nymphaea.* Recent field work by us has revealed a petaloid form of *Ondinea* which warrants recognition as a new subspecies. The presence of petals in the genus provides further support for the placement of *Ondinea* in the Nymphaeaceae. In addition, the discovery of seedlings of *O. purpurea* enables them to be described for the first time (Figure 1A). Further studies on the gross morphology and floral biology of *Ondinea* will be published elsewhere (Schneider, in press).

Taxonomy

Ondinea Hartog, Blumea 18: 413 (1970)

Type: O. purpurea Hartog

A monotypic genus confined to sandstone streams of the Kimberley region, Western Australia.

Ondinea purpurea Hartog, loc. cit.

Type: Kimberley district, Kurunundalo or Kurunundalu, 3 miles [4.8 km] North-East of Kalimburu [Kalumburu], Western Australia, *W. Leutert* 108 (holo: sheet no. 3, CANB. 171930).

Emergent *perennial* with leaves and pedicels all arising directly from a tuber. *Tubers* 1-6, linearly arranged, erect, oblong, 1.5-2.5 cm long x 1-2 cm wide, the youngest covered at the top with fine fibrous hairs. *Roots* (some contractile) 1-1.5 mm thick, unbranched or with a few small side branches, descending from the upper part of the tuber. *Petioles* 10-40 cm long (or more where waters are deeper or tubers are deeply buried), 1 mm thick, sheathed at the base. *Submerged leaf-blade* deeply cordate, 10-17 cm long, thin, translucent, glossy, yellow-green above and often ± purplish-brown below, with entire and crispate margins; *apex* obtuse or emarginate and with a small mucro; basal lobes obtuse, 3.5-5(6) cm long x 1-1.5 cm wide with a 45°-90° divergence between them; nerve system reticulate with the main nerves apparent on the undersurface; both leaf surfaces bearing sparsely distributed small papillae, the papillae becoming more numerous close to the main and secondary nerves. *Emergent leaf-blade* floating, narrow ovate, c. 7 cm long x 2 cm broad, leathery bright light-green above and purplish below, with entire and only slightly undulate margins; basal lobes overlapping or almost so, obtuse, 2-2.5 cm long; nervation similar to that of submerged leaves. *Pedicels* terete, slightly tapered below flower, 4-60(-300) cm long, 3-6 mm wide, white below water, green above, pink to purple toward base of flower; emergent portion of pedicel 15-25 cm long with numerous longitudinal tannin stripes and fine papillae. *Flowers* solitary. *Sepals* 4, linear or slightly spathulate, 9-33 mm long and c. 1/6 as wide, obtuse, slightly convex, papillose, purple-violet on the adaxial surface, pink on the abaxial, reflexed during anthesis, spreading to erect when in fruit. *Petals* 0-4 (infrequently 5), alternating with sepals, oblong-elliptic, 13-26 mm long, 2-6 mm wide (at base), light to dark purple on both surfaces, 5 major veins, the midvein prominent. *Stamens* 15-34, inserted in close whorls at top of ovary; *filaments* broadly to narrowly oblong, 1-6 mm long becoming larger and petaloid centrifugally, with 3-5 parallel major veins, the outer veins terminating at margins below loculi, the midvein continuing upward through the connective; *loculi* purple-red to purple-brown-red, bisporangiate, lateral, dehiscing latrorsely; terminal appendage absent. *Ovary* oblong-ellipsoid, 5-9 mm long, 5 mm wide, 3 to 14 locules each with numerous 60(±20) ovules; outer wall (floral cup) purple-red to pink. *Stigmatic lobes* 3-14, whorled around prominent projecting floral axis, ventral surfaces free and forming a shallow carpellary (stigmatic) cup approximately 2 mm wide; *ventral surface* purple-red and velvet-like, papillose composed of stigmatic secretory cells. *Floral axis* cylindrical 2.5-8 mm long (from base of stigmatic cup); 1-2 mm wide, swollen distally, yellow or yellow-green, rarely green. *Fruit* an ovoid berry 10-20 mm long, 8-15 mm wide, with alternating green and purple longitudinal stripes; pericarp peeling transversely around fruit to expose locules. *Seeds* numerous, broadly ellipsoidal, c. 1 mm long with fine longitudinal striations observed at low magnification, surrounded by mucilage, brown, with a translucent aril derived from funicular outgrowth covering half the seed. *Seedlings: shoot* more or less elongating and swelling at tip to form a primary tuber, this giving rise to a rosette of leaves and adventitious contractile roots; *petiole* 20 mm long and 0.5 mm wide; *lamina* linear to very narrowly oblong, apiculate, 25 mm long and 5 mm wide.

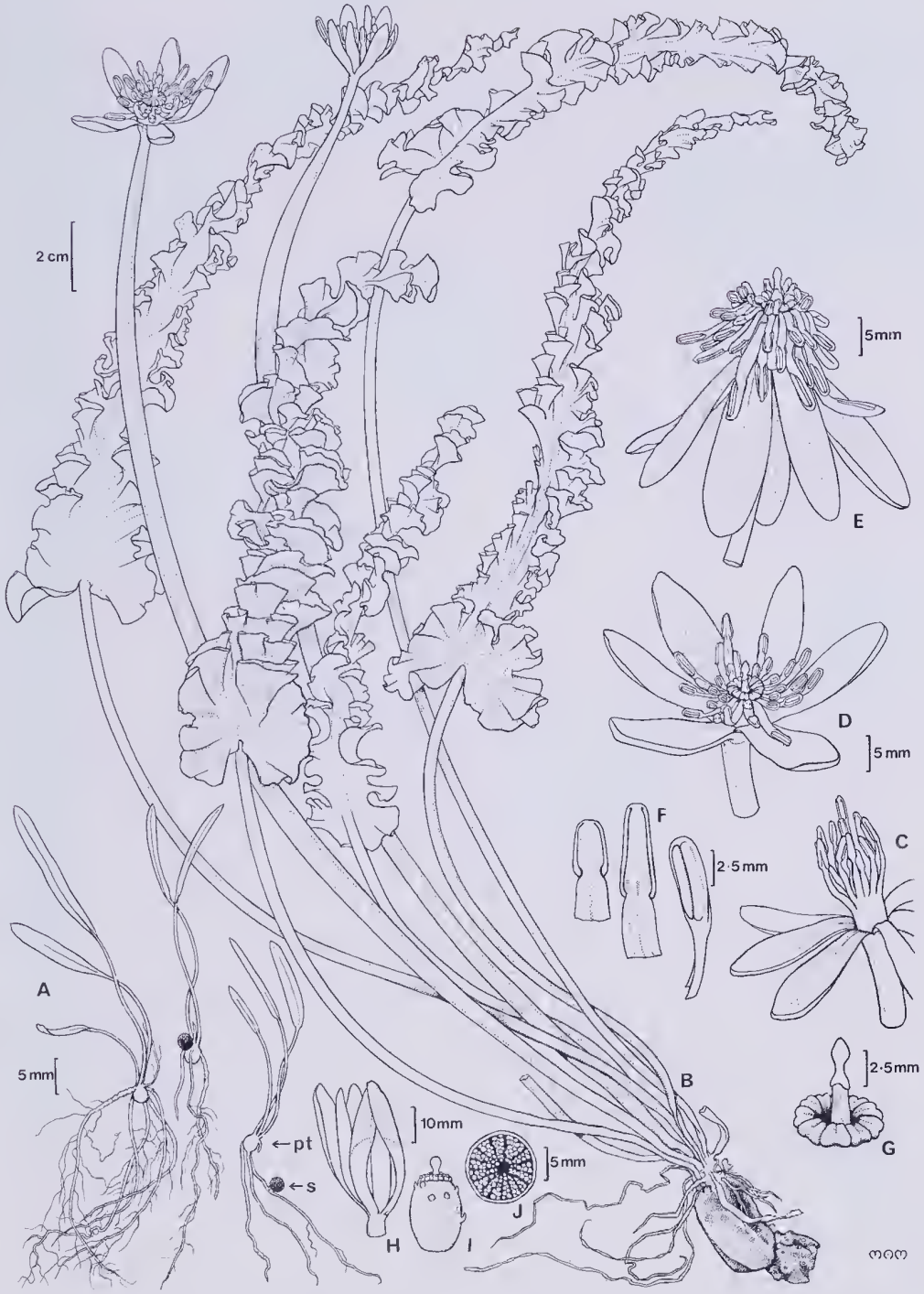

Figure 1. A—Seedling of *Ondinea purpurea* subsp. *purpurea* (s-seed; pt-primary tuber). B to J—*Ondinea purpurea* subsp. *petaloidea*. B—Habit. C to E—Flowers. F—Stamens. G—Stigmatic cup with projecting floral axis. H—Fruit enclosed by perianth. I—Fruit. J—Fruit (T.S.)

A from *K. F. Kenneally* 8179; B—J from *Schneider* s.n. (the Type).

Key to the subspecies of *Ondinea*

Petals absent, sepals less than 18 mm long, stamens 15. . . . . subsp. *purpurea*

Petals present, sepals more than 14 mm long, stamens 27-34 . . . . . subsp. *petaloidea*

subsp. **purpurea** (Figure 1A)

Sepals 4, 9-17 mm long, 1.5-3 mm wide, obtuse, slightly convex. *Petals* absent. *Stamens* 15, on the upper part of the ovary; often spirally attached, 1-6 mm long. *Ovary* oblong-ellipsoid, 5-9 mm long. *Floral axis* 2.5-3 mm long. *Fruit* 14-17 mm long and 8-11 mm wide.

Other specimens seen. WESTERN AUSTRALIA: Creeks near the Prince Regent River, *C. A. Gardner* 1353 (PERTH); Lushington Creek, Prince Regent River, *C. A. Gardner 9651* (PERTH); 3 mi (4.8 km) W of Kalumburu Mission on road to Pago, N. Kimberley, 25 April 1981, *A. Harris* s.n. (PERTH, K); Camp Creek, Mitchell Plateau, N. Kimberley, *K. F. Kenneally* 7114 (CANB, K, PERTH); Gauging Station, Camp Creek, Mitchell Plateau, N. Kimberley, *K. F. Kenneally* 8179 (PERTH, TEX); Near rockhole of the jump-up to Karunundalu, 3 mi (4.8 km) NE of Kalumburu Mission, 10 December 1968, *J. & W. Leutert* s.n. (PERTH); 1.5 mi (2.4 km) N Kalumburu Mission, *G. C. Taylor* 58 (PERTH).

Distribution. Known only from a few non-perennial creek systems extending from Kalumburu to the Prince Regent River in the Gardner District, Northern Botanical Province of Western Australia.

Ecology. Populations exhibiting emergent (floating) leaves are apparently restricted to the Kalumburu (type) area and have not been observed elsewhere. The illustration provided by den Hartog (op. cit. 414) is based on a specimen with leaves intermediate between submerged and emergent. The leaves illustrated are sagitatte with long narrow divergent lobes.

subsp. **petaloidea** Kenneally et Schneider, subsp. nov. (Figures 1 B-J and 2 A-C)

Differt a subspecie typica partibus omnibus majoribus, sepalis quoque et alabastris majoribus, numero staminum, petalis evolutis.

Typus: Small non-perennial tributary to Mitchell River, approx. 27 km NW of CRA mining camp, Mitchell Plateau, N. Kimberley (14°41′40″S, 125°40′30″E), 21 January 1982, *E. L. Schneider* s.n. (holo: PERTH; iso: CANB, K, NY, PERTH, TEX).

Robust *perennial. Sepals* 4, 15-33 mm long and 5-13 mm wide at base. *Petals* 1-4(5), oblong-elliptic, 13-26 mm long and 2-6 mm wide at base, obtuse. *Stamens* 27-34 inserted in close whorls at top of ovary, 2-16 mm long and 0.5-4 mm wide. *Ovary* oblong-ellipsoid, 8 mm long and 5 mm wide. *Floral axis* 5-8 mm long and 1-2 mm wide. *Fruit* oblong-ellipsoid 1-1.5 cm wide and 1-2 cm long.

Other specimens seen. Represented only by the type collection.

Distribution. Known only from a few non-perennial creeks in the type locality Mitchell River region, Northern Kimberley, Western Australia.

Figure 2. *Ondinea purpurea* subsp. *petaloidea*. A—Habitat. B & C—Flowers.

Ecology. Ondinea purpurea subsp. *petaloidea* is known to occur in several streams dissecting the King Leopold Sandstone portion of the Mitchell River drainage system. These streams are non-perennial, flowing during the summer wet (December-April) and becoming dry by winter (June). During the dry winter months

the oblong tubers (c. 2-5 cm x 1-2 cm) can be found embedded in the alluvial sand of the open stream-bed or in crevices among large sandstone boulders at depths of 4-45 cm. The texture of the alluvial substrate is 98% sand, 1% clay and 1% silt. The soil is further characterized by possessing a low organic content (0.2%).

From field observations it appears that young (small) tubers are shallowly rooted in the sandy soils. The presence and activity of conspicuous contractile roots which arise near the apex of the tuber, however, pulls the enlarging tubers deep into the loose sandy soil, with the result that the largest, hence oldest, tubers occupy the deepest soil levels.

Discussion. Ondinea is a tuberous dicotyledon whose mature gross morphology, although not immediately reminiscent of nymphaeaceous s. str. architecture, exhibits vegetative, floral, and reproductive characteristics related to those of both *Hydrostemma* Wallich (= *Barclaya;* see Mabberley 1982) and *Nymphaea.*

The structural similarities between *Ondinea* and *Nymphaea* (e.g. morphological gradations from perianth through androecial members, gynoecial cups, stigmatic papillae, pollen, fruit and seed anatomy) together with similar pollination and seed dispersal syndromes lend strong support to den Hartog's placement of the former genus in the Nymphaeaceae. Further support for the inclusion of *Ondinea* in the Nymphaeaceae s. str. comes from comparative studies of stem vascularization (Weidlich pers. comm.). That *Ondinea* is closely related to *Nymphaea*, as suggested by den Hartog, is also supported on the aforementioned grounds. Whether *Ondinea* is more closely related to *Nymphaea* than other nymphaeaceous genera, especially the Indo-Malesian water lily *Hydrostemma* (Hu 1968, Stone 1978), remains unresolved. Investigations dealing with floral development and vascularization in *Ondinea* and *Hydrostemma* are presently underway and may assist in the elucidation of generic interrelationships.

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Studies in the genus *Acacia* (Leguminosae: Mimosoideae)—13. Four new species from north-western Australia

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Abstract

Maslin, B. R. Studies in the genus *Acacia* (Leguminosae: Mimosoideae)—13. Four new species from north-western Australia. Nuytsia 4(3): 367-381 (1983). Four new *Acacia* species, A. *chrysochaeta*, A. *filamentosa*, *A. richardsii* and *A. tenuispica* are described and illustrated. These species all belong to section Juliflorae (Benth.) Maiden et Betche and with the exception of *A. richardsii* which extends to the north-west corner of the Northern Territory, are confined to the northern (Kimberley) region of Western Australia.

Introduction

The following four species from *Acacia* section Juliflorae are described for inclusion in a forthcoming volume of the Flora of Australia.

With the exception of *A. richardsii* which extends to the north-west corner of the Northern Territory, these new species are confined to the Kimberley region of Western Australia. Over the past few years a number of botanical surveys have been conducted in the Kimberley (George and Kenneally 1975 and 1977, Hnatiuk and Kenneally 1981, Kenneally 1983 and McKenzie and Kenneally 1983) resulting in many new records and new taxa, including *A. tenuispica,* coming to light. This remote, northern region is topographically rugged and difficult of access and it is likely that future collecting will extend the geographical ranges of the new species included here.

For each new species all specimens have been cited. In cases where duplicates are known to exist but not examined by the author, the herbaria in which they are lodged are marked with an asterisk (*).

The Botanical District referred to in the distribution citations are those of Beard (1980). Distributions are also expressed in terms of 1:250 000 map references (see Maslin and Pedley 1982).

1. **Acacia chrysochaeta** Maslin, sp. nov. (Figure 1)

Frutex ad 1.3 m altus. *Ramuli* dense tomentosi. *Stipulae* persistentes, anguste triangulares, 2-3 mm longae. *Phyllodia* conferta, late linearia, 20-45 mm longa, 2-3 mm lata, antrorse puberula (phyllodiis juvenilibus pilis plerumque pallido-aureis ornatis), multistriata, apicibus setosis. *Spicae* 25-30 mm longae. *Sepala* ± libera, pilis plerumque pallide aureis tomentosa. *Legumina* anguste oblonga, ad 6 cm x 1 cm, dense tomentosa (pilis in leguminis juvenilibus pallide aureis). *Semina* in legumine obliqua, 4.5-5 mm longa, 2-3 mm lata, nigra.

Typus: 21 mi [33.8 km] N of Gibb River homestead, Western Australia. "Slender shrub. Creek alluvium—sandy." 27 May 1971, *N. Byrnes* 2273 (holo: PERTH; iso: K, NSW, NT).

Erect, spindly *shrubs* to 1.3 m tall, branches pendulous or spreading. *Branchlets* straight and rather sparingly divided, terete, finely nerved, brown but yellowish towards their apices, densely tomentose (hairs short, soft, weak and white although normally pale yellow on new shoots). *Stipules* persistent, conspicuously overtopping phyllodes on very young shoots, narrowly triangular, 2-3 mm long, scarious, brown or sometimes yellowish with age, longitudinally nerved, sparsely ciliolate. *Phyllodes* crowded, erect and closely pressed to stems, broadly linear, 20-45 mm long, 2-3 mm wide, antrorsely puberulous (hairs often pale yellow on young phyllodes but soon turning white); *nerves* numerous, parallel, not anastomosing, the central one more pronounced than the rest, marginal nerve yellowish; *apices* setose, 2-3 mm long, delicately curved, light brown, non-pungent; *pulvinus* squat, c. 0.5 mm long; *gland* situated on upper margin of the phyllode 1-1.5 mm above the pulvinus, oblong, c. 0.3 mm long, yellow. *Inflorescences* simple and axillary, 1 per node, numerous on upper part of branchlets. *Peduncles* 6-12 mm long, tomentose; *basal peduncular bracts* absent. *Spikes* 25-30 mm long, flowers densely arranged. *Bracteoles* conspicuously overtopping flowers in the bud; *claws* short (c. 0.5 mm); laminae acuminate, c. 1 mm long, inflexed, sparsely to moderately tomentose with white hairs. *Flowers* predominantly 5-merous (on a few flowers the sepals 6), conspicuously tomentose (hairs pale golden but sometimes turning white with age). *Sepals* about 2/3 the length of the petals, united near their base, the free portion narrowly oblong. *Petals* c. 1.5 mm long, connate for 1/2-2/3 their length. *Legumes* narrowly oblong, to 6 cm long and 1 cm wide, with up to 11 seeds, flat but slightly raised over the seeds, rarely constricted between the seeds, transversely to obliquely reticulate, densely tomentose when immature with pale golden hairs (turning whitish with age) although appearing greenish yellow due to the underlying greyish legume surface, *basal stipe* c. 5 mm long, marginal nerve thickened. *Seeds* obliquely positioned in the legume, more or less obloid, 4.5-5 mm long and 2-3 mm wide, compressed (c. 1.5 mm thick), black, slightly shiny; *pleurogram* obscure, continuous; *areole* narrowly pyriform with the narrow portion facing the hilum, c. 1.3 mm long and 0.5 mm wide, yellowish on young seeds; *funicle* filiform and c. 1 mm long, abruptly expanded into a fleshy, convoluted, pale yellowish aril which is large and pileiform near the hilum, with a thickened callosity at the hilum but this is obscured by the fleshy wings of the *aril*.

Other specimens examined. WESTERN AUSTRALIA: 21 mi (33.5 km) N of Gibb River homestead, *J. R. Maconochie* 1216 (*NSW, NT), 1294 (*AD, *B, *BRI, *CANB, K, *L, *MEL, NSW, NT, *NY, PERTH) and 1295 (NSW, NT); 32 mi (51 km) NE of Karungie Station [now called Pentecost Downs Station], *R. A. Perry* 3089 and Lazarides (*BRI, *CANB, NSW, NT); Karungie Station, *D. Rust* 50 (CANB, PERTH).

Distribution. (Figure 6) Kimberley region, northern Western Australia, in the north of the Fitzgerald Botanical District (1:250 000 map E52-1). Known only from the two localities cited above.

Habitat. Sandy alluvium on the side of a watercourse (Maconochie 1294).

Flowering and fruiting period. Near-mature legumes have been collected from late May to early June at which time flowers may also be present. A flowering specimen has been collected in November.

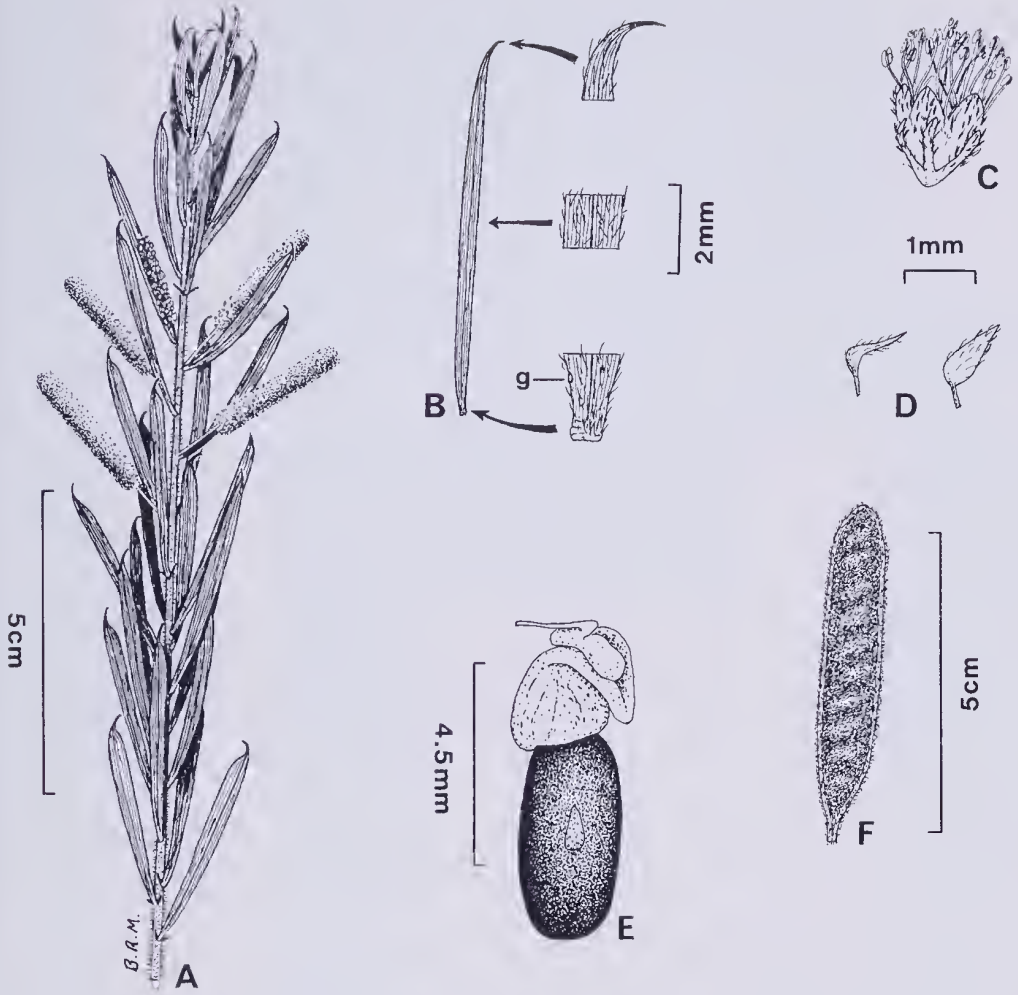

Figure 1. *Acacia chrysochaeta*. A—Portion of branch. B—Phyllode with enlargements showing the base (g-gland), middle and apex. C—Flower (indumentum pale yellow). D—Bracteoles showing large, inflexed laminae. E—Seed showing filiform funicle expanded into a large aril. F—Legume (densely tomentose).

A from *J. R. Maconochie* 1216; B-D from *D. Rust* 50; E from *J. R. Maconochie* 1295; F from *N. Byrnes* 2273 (tbe type).

The new species is most closely allied to *A. kelleri* F. Muell. and *A. dacrydioides* Tindale. The principal distinguishing features of these species are given in the key below where it is seen that *A. chrysochaeta* is readily recognized by its golden puberulous flowers, its broad, flat, densely tomentose legumes (hairs pale golden at least when young) and its flat, relatively long phyllodes.

Among the specimens cited by Tindale (1975) under *A. kelleri* were a number now referable to *A. chrysochaeta* viz. Byrnes 2273, Maconochie 1216, 1294, and 1295, and Perry 3089. Tindale also cited Gardner 1534 from Wade Creek, Vansittart Bay. This collection may represent a distinct taxon (see key below) but field studies and

further material are required to ascertain this. Because these taxa grow in the remote northern areas of Western Australia where access is difficult and generally little collecting has been done, most are represented by very few herbarium collections. This makes difficult an accurate assessment of the range of morphological variation. Nevertheless, in my view the collections indicate that Tindale's (1975) concept of *A. kelleri* is too broad and the species is therefore segregated into *A. kelleri, A. chrysochaeta* and *A.* aff. *kelleri* (see Gardner 1534). The known geographic range of these three taxa is shown in Figure 5.

Tindale (1975) stated that *A. kelleri* was distinguished from *A. dacrydioides* by its legumes. However, as can be seen from the key below, the carpological characters of these two species are essentially the same. From an examination of all specimens cited in the above work it is evident that Tindale did not see legumes of *A. kelleri* but only those of *A. chrysochaeta, A. dacrydioides* and *A.* aff. *kelleri.*

The specific epithet refers to the characteristic golden hairs of the flowers and young legumes.

Key to *Acacia kelleri* and its allies

1a. Phyllodes subterete, less than 1 mm wide, 6-13 mm long; legumes submoniliform, to 5 mm wide, red-brown, glabrous, longitudinally striate, margins not thickened; seeds longitudinal in legume; calyx divided for 1/3-1/2 its length, together with petals strongly nerved and glabrous or white hairy . . . . . *A. dacrydioides*

b. Phyllodes distinctly flat, 1-3 mm wide; calyx divided to near base into more or less narrowly oblong sepals 2

2a. Phyllodes 2-4.5 cm long; legumes 1 cm wide, flat, densely tomentose (hairs pale golden but turning white with age), transversely to obliquely reticulate, margins thickened; petals and sepals pale golden tomentose (hairs sometimes turning white with age; seeds oblique in legume . . . . . *A. chrysochaeata*

b. Phyllodes 1-2.5 cm long; legumes 4-6 mm wide, glabrous or white puberulous; sepals and petals glabrous or white hairy; seeds more or less longitudinal in legume 3

3a. Legumes submoniliform, red-brown, glabrous (rarely minutely white-puberulous), longitudinally striate, margins not thickened. . . . . *A. kelleri*

b. Legumes flat, raised over but not constricted between seeds, densely minutely white puberulous with the hairs obscuring the obliquely transverse nerves, margins thickened (cf. Gardner 1534 in discussion above) . . . . . *A.* aff. *kelleri*

2. **Acacia filamentosa** Maslin, sp. nov. (Figure 2)

Ramuli glabri. *Stipulae* deciduae. *Phyllodia* crasse filiformia, 17-25 cm longa, c. 1 mm diam., obscurissime multistriata. *Spicae* 20-25 mm longae, 6 mm latae (in sicco). *Pedunculi* 5-15 mm longi. *Flores* 5-meri. *Calyx* brevissime lobatus, 5-nervatus. *Petala* 1-nervata. *Legumina* (in statu submaturo) linearia, ad 11 cm longa, 3 mm lata, striata, glabra. *Semina* (in statu submaturo) in legumine longitudinalia, 6-7 mm longa, 2 mm lata.

Typus: Gibb River road (between Derby and Wyndham) near Ellenbrae turn-off, Western Australia. "Shrub to 2 m." 25 August 1980, *P. Luscombe* s.n. (holo: PERTH; iso: K, PERTH).

Shrubs to 2 m tall (Luscombe s.n.). *Branchlets* sparingly divided, normally slightly flexuose, terete, obscurely nerved, glabrous, red-brown. *Stipules* deciduous. *Phyllodes* coarsely filiform, 17-25 cm long, c. 1 mm diam., terete, ascending, not rigid, curved or shallowly sinuous, glabrous, obscurely longitudinally sulcate, terminating in an innocuous apical callose point which is frequently slightly uncinate; *nerves* numerous and very obscure, sometimes resinous (resin yellow and translucent); *pulvinus* 1.5-2 mm long, coarsely wrinkled; *gland* obscure, situated on upper surface of the phyllode 1-3 mm above the pulvinus, lamina often slightly swollen about the gland. *Inflorescences* simple and axillary, normally 2 per node. *Peduncles* 5-15 mm long, glabrous; *basal peduncular bracts* deciduous. *Spikes* 20-25 mm long and 6 mm wide (when dry), flowers densely arranged, buds shortly cylindrical and elongating with maturity. *Bracteoles* sub-peltate, c. 1 mm long, claws linear. *Flowers* 5-merous, glabrous. *Calyx* gamosepalous, about 1/2 the length of the corolla, very shallowly divided into broadly triangular, slightly thickened, inflexed lobes, tube 5-nerved. *Petals* 2 mm long, strongly 1-nerved when dry. *Legumes* (few seen and slightly immature) linear, to 11 cm long, 3 mm wide, crustaceous to thinly coriaceous, flat but slightly raised over and slightly constricted between the seeds, longitudinally striate, glabrous, greyish brown; margins yellowish, not thickened. *Seeds* (few seen and slightly immature) longitudinally positioned within the legume, elongated obloid, 6-7 mm long, c. 2 mm wide, brown, marked with an indistinct yellowish peripheral nerve; *pleurogram* obscure, open towards the hilum, bordered by a narrow band of pale coloured tissue; *areole* 5-6 mm long, 1 mm wide; *funicle-aril* turbinate, slightly convoluted, pale yellowish.

Other specimens examined. WESTERN AUSTRALIA: Karungie [now called Pentecost Downs Station], 16°15'S, 127°15'E, *B. Gill* A1 (PERTH); 21 mi (33.5 km) SW of Kalumburu Mission, *N. H. Speck* 4923 (*BRI, PERTH.)

Distribution. (Figure 6) Kimberley region, northern Western Australia, in the Fitzgerald and Gardner Botanical Districts (1:250 000 maps D52-9, 13; E52-1). Known only from three collections gathered between Pentecost Downs Station north to near Kalumburu Mission.

Habitat. Top of a sandstone mesa (N. H. Speck 4923).

Flowering and fruiting period. Specimens in bud have been collected in August and September. The type (collected late August) is in bud, has spikes at anthesis as well as legumes with near-mature seeds.

Although the new species is placed in section Juliflorae (Benth.) Maiden et Betche, its affinities to the other members of this group are not clear. Juliflorae species with long, terete phyllodes are rare in the far north (Kimberley) of Western Australia although further south, particularly in the arid zone, they are more frequent eg. *A. exilis* Maslin, *A. cyperophylla* F. Muell., *A. linophylla* W. V. Fitzg., *A. tenuissima* F. Muell. and *A. wanyu* Tindale. *Acacia filamentosa* is seemingly not closely related to any of these species being characterized by its very long, obscurely

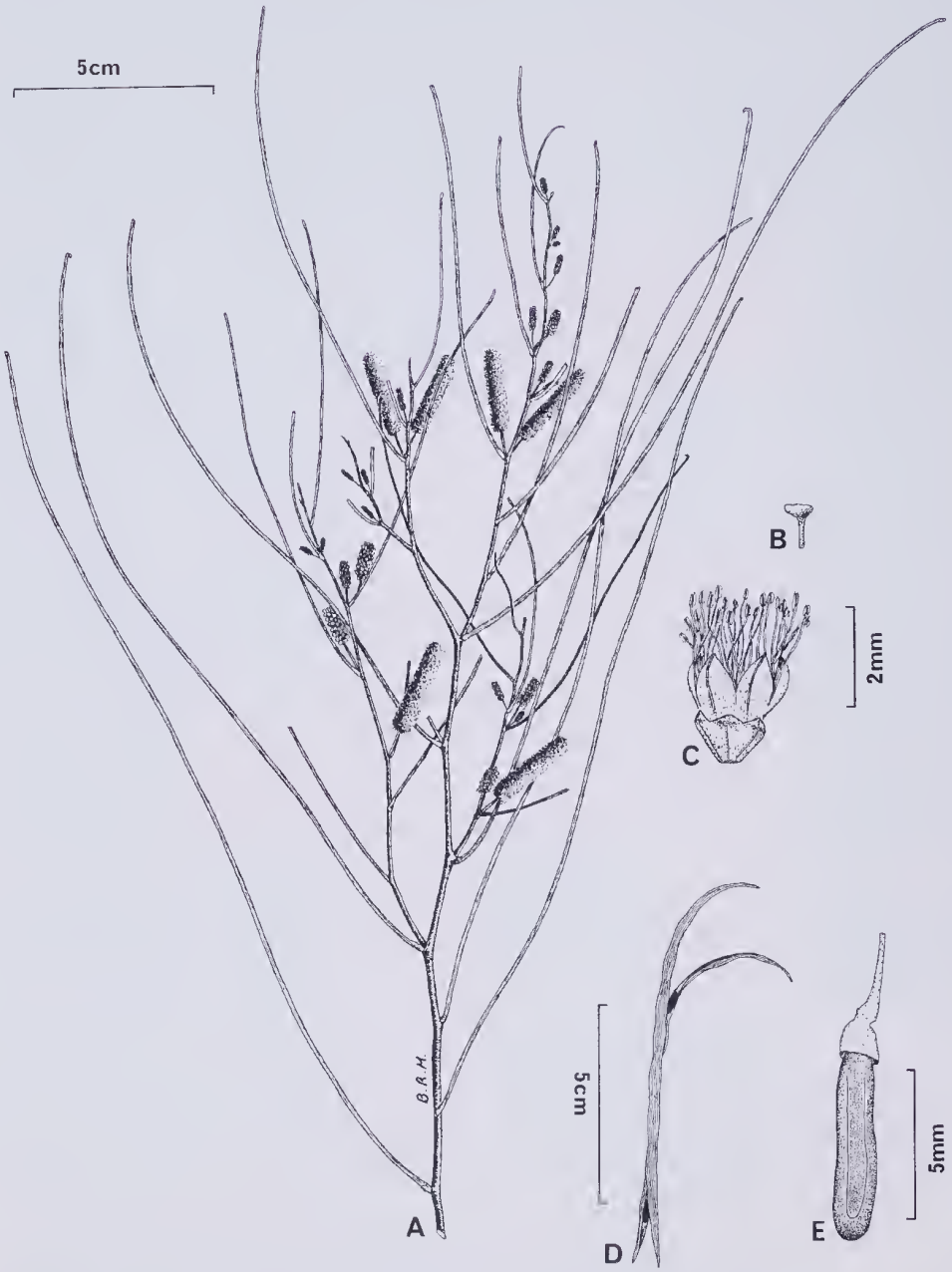

Figure 2. *Acacia filamentosa*. A—Portion of branch. B—Bracteole. C—Flower. D—Legume (slightly immature and partly dehisced). E—Seed (slightly immature) showing the pleurogram bordered by a band of pale tissue.

All from *P. Luscombe* s.n. (the type).

nerved phyllodes and its narrow, flat, striate legumes. *Acacia orthocarpa* F. Muell. is the only Kimberley Juliflorae species which has relatively long (to 11 cm), terete phyllodes. *Acacia orthocarpa* is readily distinguished from the new species by its punctulate phyllodes, smaller flowers and woody legumes.

The specific epithet refers to the very long, coarsely filiform phyllodes.

3. **Acacia richardsii** Maslin, sp. nov. (Figures 3 and 4)

Frutex 3-4 m altus. *Ramuli* glabri, costis resinosis. *Phyllodia* leviter oblique elliptica ad anguste elliptica, 17-40 mm longa, 4.5-8.5 mm lata, glabra, resinosa, 2-nervata, reticulata, glandibus 2-5. *Pedunculi* 5-10(15) mm longi, glabri. *Spicae* 2-3 cm longae, 2-4 mm latae (in sicco). *Flores* 5-meri. *Sepala* libera. *Legumina* lignosa, anguste alata, badia. *Semina* in legumine obliqua, 4.5 mm longa, c. 1.5 mm lata; *funiculus-arillus* strictus, anguste turbinatus.

Typus: Kelly's Knob Lookout, Kununurra, Western Australia. "Shrub to about 2.5 m; bark hard, grey, moderately rough. Habitat of massive sandstone." 14 August 1981, *C. Done* 492 (holo: PERTH; iso: DNA).

Rounded to more or less obconic *shrubs* to 3-4 m tall, either single-stemmed or sparingly branched at ground level, crowns rather dense and bushy, main branches slender and erect. *Bark* light to medium grey, finely longitudinally fissured and sometimes slightly flaking at base of main stem(s), otherwise smooth. *New shoots* either terminal on vegetative branch or arising within axil of phyllode at base of the peduncle, young phyllodes light green with yellow tips. *Branchlets* glabrous, green or yellowish, terete although marked with resin ribs which give an angular appearance especially near their apices, the resin is yellow, translucent, convoluted and drying mealy white. *Stipules* triangular to narrowly triangular, inconspicuous, 0.5-1 mm long, somewhat thickened. *Phyllodes* elliptic to narrowly elliptic, slightly asymmetric, 17-40 mm long, 4.5-8.5 mm wide, length to width ratio 3-6(8.5), ascending, thinly coriaceous, not rigid, subglaucous, glabrous, variably resinous (resin more pronounced on young phyllodes); *nerves* often yellowish and resinous (the resin drying mealy white and rendering the overall venation pattern quite evident), with 2 main longitudinal nerves (one more or less central and a less pronounced one on its adaxial side), main nerves not basally confluent with the margin, minor lateral veins openly anastomosing and trending longitudinally; *apex* rounded and terminating in a laterally positioned, innocuous, callose point; *pulvinus* not prominent, c. 0.5 mm long, yellowish; *glands* 2-5 scattered along upper margin of the phyllode, margin often shallowly indented about the gland, not prominent, circular, c. 0.3 mm diam., yellowish. *Inflorescences* simple and axillary, 1-2 per node. *Peduncles* 5-10(15) mm long, glabrous; *basal peduncular bract* solitary, rather persistent, c. 1 mm long, ovate, acuminate, concave, brown. *Spikes* 2-3 cm long and 2-4 mm wide (on dry specimens), flowers somewhat densely arranged. *Bracteoles* sub-peltate, c. 0.7 mm long, claws filiform. *Flowers* 5-merous, glabrous, slightly resinous. *Sepals* free, about 1/2 the length of the petals, claws filiform and expanded into narrowly ovate laminae. *Petals* c. 1.2 mm long, connate for c. 1/2 their length, obscurely 1-nerved. *Legumes* erect, broadly linear to narrowly oblong although tapering towards their base, to 8 cm long, 5-6 mm wide, woody, straight or slightly curved, neither raised over nor constricted between the seeds, resinous, glabrous, red-brown, obliquely longitudinally nerved, margins narrowly winged on either side of the suture (wing 2-3 mm wide) producing a quadrangular cross-sectional shape particularly noticeable on young legumes, valves opening elastically from the apex and becoming prominently recurved with

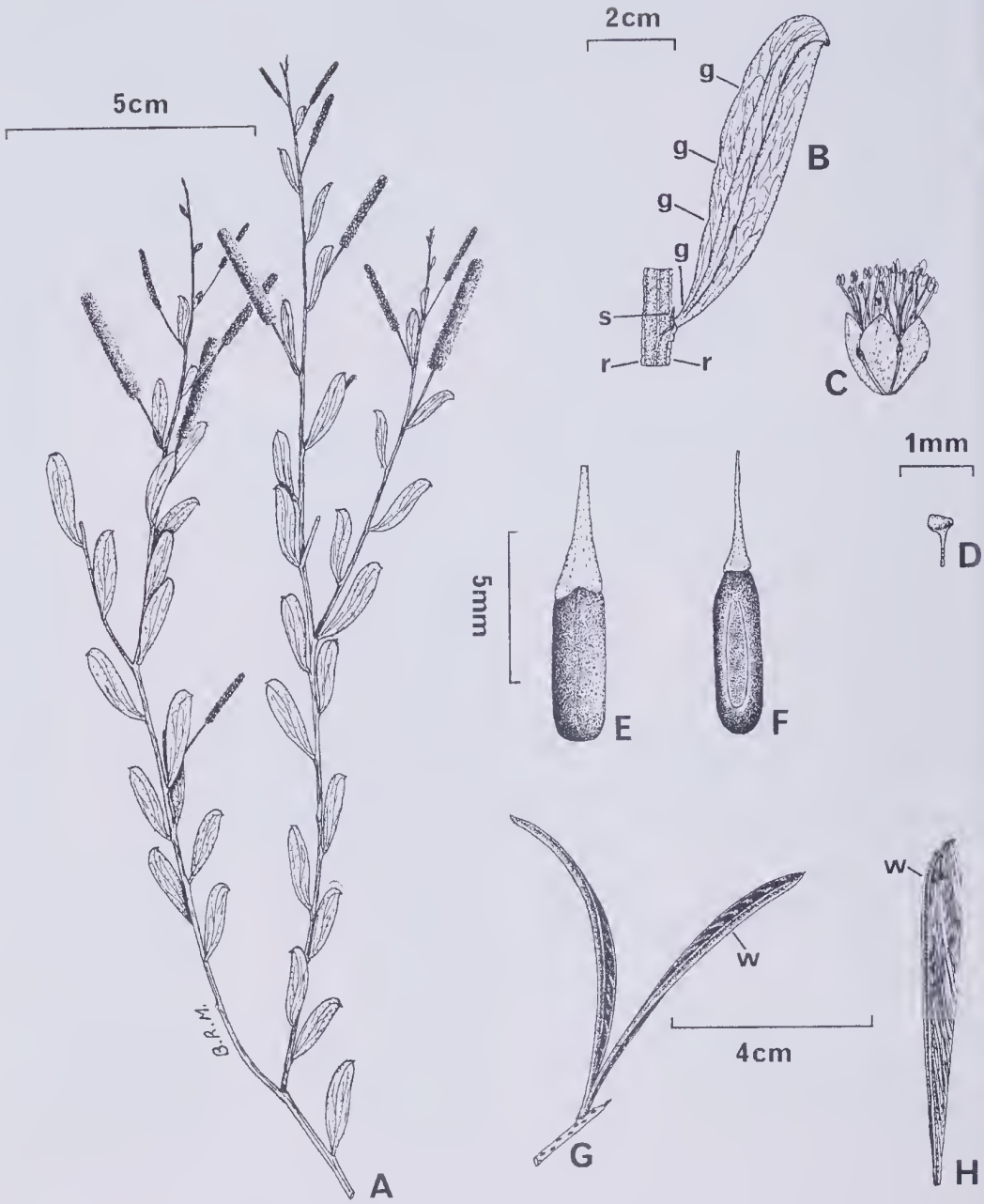

Figure 3. *Acacia richardsii*. A—Portion of branch. B—Node showing convoluted resin-ribs (r), minute stipules and phyllode with multiple glands (g) along upper margin. C—Flower showing free sepals. D—Bracteole. E—Seed (end view) showing obscure, yellowish peripheral nerve. F—Seed (side view) showing pleurogram bordered by a band of yellowish tissue. G—Legume (dehisced) showing marginal wing (w). H—Legume (undehisced) showing marginal wing (w) and obliquely longitudinal nervation pattern.

A from C. Done 492 (holotype); B from *B. R. Maslin* 5144; C—D from *T. G. Hartley* 14398; E—H from *R. J. Petheram* 474.

age. *Seeds* positioned obliquely in the legume in pronounced depressions which are separated by thin oblique partitions, elongated obloid, 4.5 mm long, c. 1.5 mm wide, turgid, somewhat shiny, greyish brown, with an obscure yellowish peripheral nerve; *pleurogram* fine, open towards the hilum, bordered by a band of yellowish tissue; *areole* elongated, c. 3 mm long and 0.7 mm wide; *funicle-aril* narrowly turbinate, straight, c. 4 mm long, pale yellow.

Other specimens examined. NORTHERN TERRITORY: Keep River National Park, 5 Aug. 1981, 29 Oct. 1981 and 2 Nov. 1981, *S. King* s.n. (DNA); Keep River National Park, 15°47′S, 129°02′E, *A. S. Mitchell* 314 (DNA).
WESTERN AUSTRALIA: Headwaters of Packsaddle Creek, Northern Carr Boyd Ranges, 15°56′S, 128°40′E, *T. G. Hartley* 14389 and 14403 (both PERTH—dups. ex CANB); Near Hookers Farm, Ivanhoe Crossing Road, Ord River Valley, *K. F. Kenneally* 1896 (PERTH); Kellys Knob, Kununurra, 15°46′S, 128°44′E, *K. F. Kenneally* 7237 (NSW, PERTH) and 7523 (BRI, CANB, K, PERTH); Kellys Knob, Kununurra, *B. R. Maslin* 5144 and 5144A (both PERTH); Hidden Valley, Kununurra, *B. R. Maslin* 5150 (PERTH); Lookout behind Kununurra, 16 Sept. 1966, *C. Palzer* and *R. Fox* 712 (DNA); Kellys Knob, Kununurra, *R. J. Petheram* 474 (K. MEL, PERTH); Hidden Valley, Kununurra, *M. Simmons* 19 (PERTH).

Figure 4. *Acacia richardsii*. Photograph of *B. R. Maslin* 5150 at Hidden Valley, Kununurra.

Distribution. (Figure 6) Known only from a small area on either side of the Western Australia-Northern Territory border from near Kununurra (W.A., 15°46′S, 128°44′E) to the Keep River National Park (N.T., 15°47′S, 129°02′E)—1:250 000 maps D52-14, 15.

Habitat. Apparently restricted to rocky sandstone areas.

Flowering and fruiting period. Flowering from (March) June-October. Flowering specimens collected from August to October frequently possess legumes in varying stages of maturity.

Due to its glabrous, resinous branchlets, free sepals, woody, winged, obliquely nerved legumes and seed characters the new species is allied to *A. tenuispica* Maslin, *A. conjunctifolia* F. Muell. and *A. gonocarpa* F. Muell. but is readily distinguished by its small, 2-nerved, openly reticulate phyllodes. In its phyllodes *A. richardsii* superficially resembles the Pilbara "Minni Ritchi" species *A. effusa* Maslin (1982), however, the two taxa, are otherwise quite dissimilar. On account of its small oblique phyllodes, spicate inflorescences and woody, erect, obliquely nerved legumes *A. richardsii* may possibly be mistaken for *A. wickhamii* Benth., however, the latter species is easily distinguished by its non-reticulate phyllodes, its gamosepalous calyx and its legumes which have prominent marginal ribs but which are not laterally winged.

The species is named after Quentin Richards in recognition of his fine work as a botanical assistant at the Western Australian Herbarium from 1980 to 1982.

4. **Acacia tenuispica** Maslin, sp. nov. (Figure 5)

Frutex ad 4 m altus, ut videtur ad *arborem* 6 m altam evolutus. *Ramuli* variabiliter tuberculati, glabri, resinosi. *Phyllodia* oblique anguste elliptica, (3)4-7 cm longa, 6-16 mm lata, glabra, resinosa, multinervia, glandibus 2(3). *Pedunculi* 1.5-3 mm longi. *Spicae* 15-45 mm longae, c. 2.5 mm latae (sub anthesi). *Flores* 5-meri. *Sepala* libera. *Legumina* lignosa, anguste alata, badia. *Semina* in legumine obliqua, ellipsoidea, 4-4.5 mm longa, c. 2.5 mm lata; *funiculus-arillus* strictus, anguste turbinatus.

Typus: Kalumburu Mission, about 4 km N of the Mission buildings, Western Australia. "Spreading, ±infundibular shrub 2.5-3 m tall, trunk dividing just above ground level into 2-3 spreading-erect branches. Bark grey, finely longitudinally fissured on the main branches. Branchlets green, nerves white. Phyllodes patent, distinctly subglaucous. Common on laterite in low-lying area within Eucalyptus woodland. Also common along a nearby sandstone creek." 30 January 1982, *B. R. Maslin* 5151 (holo: PERTH; iso: CANB, K).

Spreading, openly branched, more or less obconic *shrubs* normally to 4 m tall, apparently growing to a *tree* 6 m tall (A. S. George 13764), trunk dividing just above ground level into 2-3 main branches. *Bark* grey, finely longitudinally fissured on main branches. *Branchlets* terete but rather coarsely ribbed, becoming somewhat angular towards their apices, red-brown but apically greenish, variably tuberculate (tubercles very small and yellowish), glabrous, slightly resinous (resin not confined to the ribs). *Stipules* deciduous. *Phyllodes* asymmetrically narrowly elliptic with the upper margin more convex than the lower margin, narrowed toward the apex into a minute, recurved, innocuous callose point, (3)4-7 cm long, 6-16 mm wide, length to width ratio 4-8, patent to ascending, thinly coriaceous, not rigid, glabrous, slightly

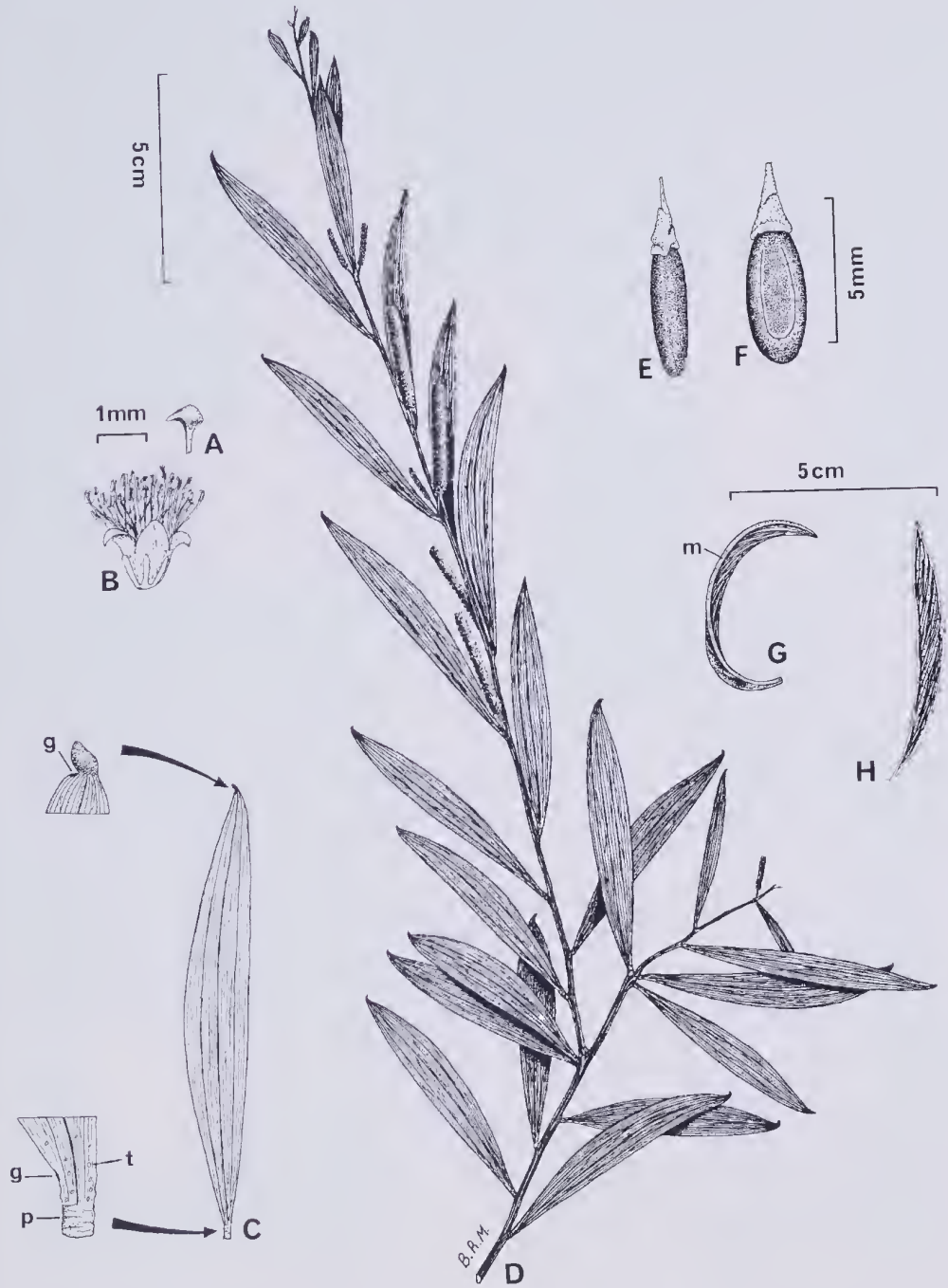

Figure 5. *Acacia tenuispica*. A—Bracteole. B—Flower. C—Phyllode showing 3 nerves more pronounced than the fine intervening venules—enlargements showing apical mucro with gland (g) at its base, and base of phyllode with pulvinus (p), gland (g) and few tubercules (t). D—Portion of branch. E—Seed (end view) showing pale peripheral nerve. F—Seed (side view) showing pleurogram bordered by a band of pale tissue. G—Legume valve showing narrowly winged margin (m). H—Legume showing obliquely longitudinal nervation pattern.

A—D from *A. S. George* 13841; E—F from B. R. Maslin 5151 (holotype); G—H from *A. S. George* 13764.

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resinous, phyllodes normally brownish green when dry but sometimes subglaucous (cf. the type), sparsely tuberculate; *nerves* longitudinal and not basally confluent with the margin, 3(5) slightly more pronounced than the very fine, parallel, intervening venules which sometimes slightly anastomose; *pulvinus* squat, c. 1 mm long, brown (when dry); *glands* 2(3) on upper margin of phyllodes, proximal gland to 3 mm above the pulvinus, the distal gland situated just below the callose point, sometimes a third gland between the other two. *Inflorescences* simple and axillary, 2 per node. *Peduncles* 1.5-3 mm long, glabrous, resinous, frequently tuberculate; *basal peduncular bract* triangular, c. 1.5 mm long. *Spikes* variable in length, 15-45 mm long, apparently elongating with maturity, narrow (about 2.5 mm diam. just prior to anthesis), resinous (especially when young), flowers dense in the bud but somewhat distant at maturity. *Bracteoles* c. 0.8 mm long, glabrous; *claws* linear; *laminae* inflexed, thickened and concave. *Flowers* 5-merous, glabrous, somewhat resinous. *Sepals* c. 1/2 length of petals, free, narrowly oblong, membranous. *Petals* c. 1 mm long. *Legumes* erect, more or less narrowly oblong although tapering towards their base, to 7.5 cm long and 8 mm wide, woody, straight or slightly curved, neither raised over nor constricted between the seeds, resinous, glabrous, red-brown, obliquely longitudinally nerved, margins narrowly winged on either side of the suture (wing c. 2 mm wide) producing a quadrangular cross-sectional shape particularly noticeable on young legumes, valves opening elastically from the apex and becoming prominently recurved with age. *Seeds* obliquely positioned in the legume in pronounced depressions which are separated by thin oblique partitions, ellipsoid, 4-4.5 mm long, c. 2.5 mm wide, slightly compressed (c. 1.5 mm thick), somewhat shiny, brown, with a fine yellow peripheral nerve; *pleurogram* fine, open towards the hilum, bordered by a band of yellowish tissue; *areole* elongated, c. 3.5 mm long and 1 mm wide; *funicle-aril* narrowly turbinate, straight, c. 3 mm long, pale cream, slightly coarsely wrinkled.

Other specimens examined. WESTERN AUSTRALIA: Blyxa Creek, Prince Regent River Reserve, 15°48′S, 125°20′E, *A. S. George* 12492 (BRI, PERTH); S end of Ashton Range, near Dromains Creek, Drysdale River National Park, c. 15° 16′S, 126° 43′E, *A. S. George* 13295 (PERTH); Orchid Creek, below Carson Escarpment, Drysdale River National Park, *A. S. George* 13630 (PERTH); Near Solea Falls, Drysdale River, Drysdale River National Park, c. 14° 40′S, 127° 00′E, *A. S. George* 13764 (PERTH); Conical Gorge, Carson Escarpment, Drysdale River National Park, c. 15° 02′S, 126° 49′E, *A. S. George* 13841 (PERTH); Morgan Falls, Drysdale River, Drysdale River National Park, c. 15° 02′S, 126° 40′E, *A. S. George* 14046 (PERTH); Boiga Falls, Drysdale River National Park, 15° 08′S, 127° 06′E, *K. F. Kenneally* 4004 (PERTH); Cracticus Falls, Drysdale River National Park, 14° 47′S, 127° 05′E, *K. F. Kenneally* 4141 (PERTH); Nymphaea Creek, Drysdale River National Park, 14° 49′S, 126° 55′E, *K. F. Kenneally* 4279 (PERTH).

Distribution. (Figure 6) Kimberley region, northern Western Australia, in the Gardner Botanical District (1:250 000 maps D51-16; D52-9, 13). Ranging from the Prince Regent River (15° 48′S, 125° 20′E) to the Drysdale River area (c. 15°S, 127°E). In the Drysdale River area the species appears to be common, but around the Prince Regent River it is known only from a single gathering. This may merely reflect collecting activity in the respective areas.

Habitat. Rocky soil (sandstone, siltstone, basalt or laterite) principally in low open *Eucalyptus* woodland or sometimes tall shrubland (see George and Kenneally, 1975 and 1977, where the species is called *A. brevifolia* Benth., *A.* aff. *leptophleba* F. Muell. and *Acacia* sp.).

Flowering and fruiting period. All collections except the type were made in August at which time specimens were either sterile, in flower or in mature fruit. At the type locality in January most plants were sterile but a few were in flower or possessed mature legumes.

Its carpological characters, narrow spikes and free sepals relate *A. tenuispica* to *A. richardsii* but the new species is readily distinguished by its larger, differently shaped phyllodes with their more numerous, rarely anastomosing nerves (compare Figures 3 and 5). The known ranges of these two new species do not overlap. Other allied Juliflorae species with similar floral and legume characters are *A. conjunctifolia* F. Muell. and *A. gonocarpa* F. Muell. From the former species *A. tenuispica* is distinguished by its much larger, non-clustered phyllodes and from the latter by its more narrowly winged legumes and much broader phyllodes. *Acacia lentiginea* Maiden et Blakely seems also to be related to the new species but the latter is distinguished by its generally shorter and broader phyllodes and its more coarsely ribbed branchlet apices. *Acacia lentiginea* is known only from the two collections (both of which I have examined) cited in the protologue viz. Prince Regent River, C. A. Gardner 1369 (NSW, PERTH) and Brunswick Bay, A. Cunningham 296 (K). I have not seen legumes of *A. lentiginea.*

The specific epithet refers to the narrow spikes.

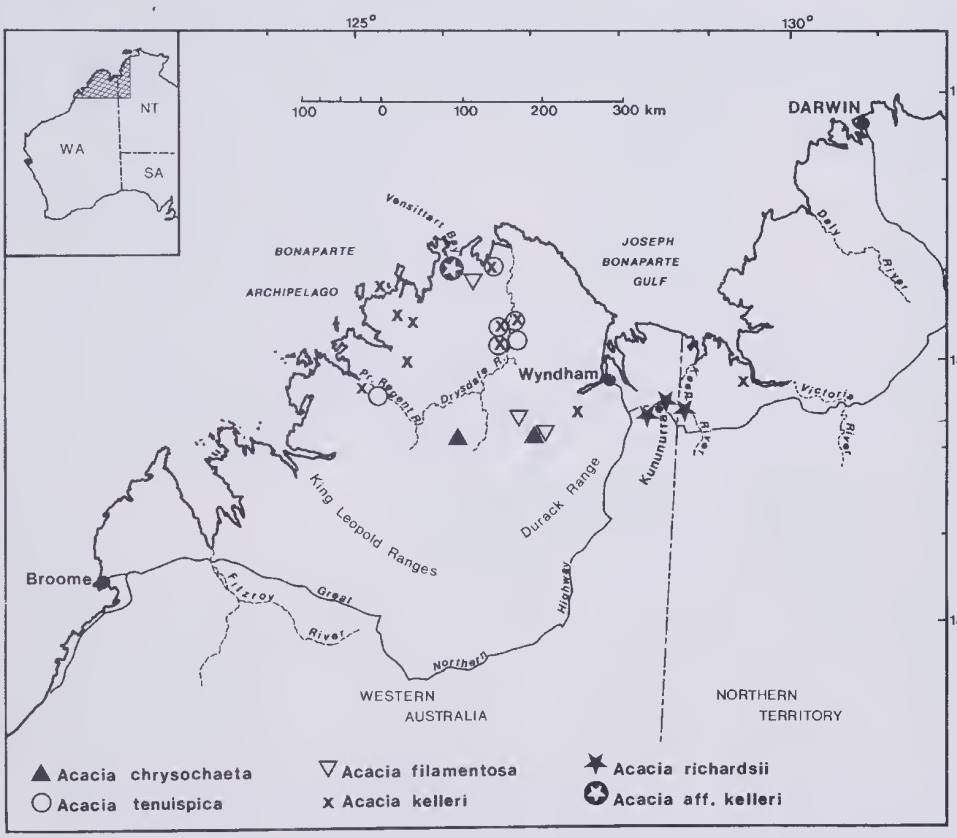

Figure 6. Distribution of *Acacia chrysochaeta, A. kelleri, A.* aff. *kelleri* (based on *C. A. Gardner* 1534), *A. filamentosa, A. richardsii* and *A. tenuispica* N.B. The distribution shown for *A. kelleri* includes 2 specimen records for which the localities are rather vague, viz. Prince Regent River, *W. T. Allen* s.n.; lower part of the Victoria River, *R. J. Winters* 16.

Acknowledgments

I wish to thank Les Pedley (Queensland Herbarium, BRI) for his useful comments on most of the included taxa. Professor K. H. Rechinger is thanked for checking the Latin descriptions. I would also like to thank Tom Farrell of C.R.A. Services Melbourne for arranging with the Mitchell Plateau Bauxite Company an airfare to the Kimberley region and support facilities on the Mitchell Plateau in January 1982. Chris Done (W.A. Forest Dept.) is thanked for his assistance during my visit to the Kununurra area. I am grateful to the Directors of the following herbaria for the loan of specimens used in this study: BRI, CANB, DNA, K, NSW, NT. Suzanne Curry is thanked for her very competent technical assistance. The project was conducted at the Western Australian Herbarium (PERTH) with financial assistance provided under an Australian Biological Resources Study grant from the Bureau of Flora and Fauna.

Index to specimens studied

This index is arranged alphabetically according to the name of the collector. Numbers in parentheses refer to the corresponding numbered species in the text. Specimens marked with an asterisk (*) have not been examined by the author. Unless otherwise indicated, the specimens cited are housed at the Western Australian Herbarium (PERTH). Abbreviations for herbaria are those given in Index Herbariorum, Part 1, Edition 7 (1981). In the case of Kings Park and Botanic Garden, Perth there is no formal abbreviation so KP is used informally here.

Byrnes, N. 2273(1-Type: K, NSW, NT, PERTH)

Done, C. 492(3-Type: DNA, PERTH)

George, A. S. 12492(4-Bri, PERTH), 13295(4), 13630(4), 13764(4), 13841(4), 14046(4)

Gill, B. A1(2)

Hartley, T. G. 14389(3), 14403(3)

Kenneally, K. F. 1896(3), 4004(4), 4141(4), 4279(4), 7237(3-NSW, PERTH), 7523(3-BRI, CANB, K, PERTH)

King, S. s.n. 5 Aug. 1981, 29 Oct. 1981, 2 Nov. 1981 (all 3-DNA)

Luscombe, P. s.n. 25 Aug. 1980 (2-Type: K, PERTH)

Maconochie, J. R. 1216(1-NSW, NT), 1294(1-*AD, *B, *BRI, *CANB, K, *L, *MEL, NSW, NT, *NY, PERTH), 1295(1-NSW, NT)

Maslin, B. R. 5144(3), 5144A(3), 5150(3), 5151 (4-Type: CANB, K, PERTH)

Mitchell, A. S. 314(3-DNA)

Palzer, C. and Fox, R. 712(3-DNA)

Perry, R. A. with Lazarides, M. 3089(1-*BRI, *CANB, NSW, NT)

Petheram, R. J. 474(3-K, MEL, PERTH)

Rust, D. 50(1-CANB, PERTH)

Simmons, M. 19(3)

Speck, N. H. 4923(2-*BRI, PERTH)

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Studies in the genus *Acacia* (Leguminosae: Mimosoideae)-14. New taxa from north-west Western Australia

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Abstract

Maslin, B. R. Studies in the genus *Acacia* (Leguminosae: Mimosoideae)-14. New taxa from north-west Western Australia. Nuytsia 4(3): 383-410 (1983). Six new species occurring in the region between the Ashburton and Murchison rivers, north-west Western Australia, are described and illustrated viz. *A anastema, A. distans, A. drepanophylla, A. intorta* (all section Juliflorae), *A. galeata* and *A. sibilans* (both section Plurinerves). A putative hybrid between *A. ancistrocarpa* Maiden et Blakely and *A. trachycarpa* E. Pritzel is also described and illustrated. This taxon is known from a few scattered localities in the Pilbara region.

Introduction

The following six species and one putative hybrid are described in order that they may be included in a forthcoming volume of the Flora of Australia. Four occur in section Juliflorae and two in section Plurinerves, as indicated below under each species.

With the exception of the putative hybrid the species are mostly confined to the extreme western part of the arid zone between the Murchison and Ashburton rivers in Western Australia. Arid zone *Acacia* species, especially those from sections Plurinerves and Juliflorae, frequently have what appear to be erratic flowering and fruiting phenologies (seemingly related to the incidence of rainfall) and this certainly applies to most taxa included here. Maslin and Hopper (1982) have interpreted this phenological response to rainfall as being indicative of a long period of evolution of these sections within the arid zone.

The Botanical Districts referred to below are those of Beard (1980).Taxa are also referred to 1:250 000 map sheets (Maslin and Pedley 1982).

1. **Acacia anastema** Maslin, sp. nov. (Figures 1 and 2)

Arbor ad 6 m altus. *Phyllodia* linearia, acuminata, (11)15-25(32) cm longa, 2-6 mm lata, patentia, falcata, multistriata. *Spicae* 2-4 cm longae, ad 8 mm latae. *Sepala* ± libera. *Legumina* linearia, ad 14 cm longa, 2-3 mm lata, teretia. *Semina* in legumine longitudinalia, breviter cylindrica, 5-5.5 mm longa, 2-3 mm lata.

Typus: 35 km S of Gascoyne Junction on the road to Towrana Station, Western Australia. "Tree to 6 m tall, either single-stemmed or dividing into 2(3) trunks at ground level; bark grey, fissured on main trunks, smooth on branches; mature phyllodes falcate, spreading, grey-green; new shoots light yellowish green and slightly resinous; spikes bright golden. Confined to a red sand ridge." 29 July 1981, *B. R. Maslin* 5004 (holo: PERTH; iso: BM, BRI, CANB, G, K, MEL, NSW, NY).

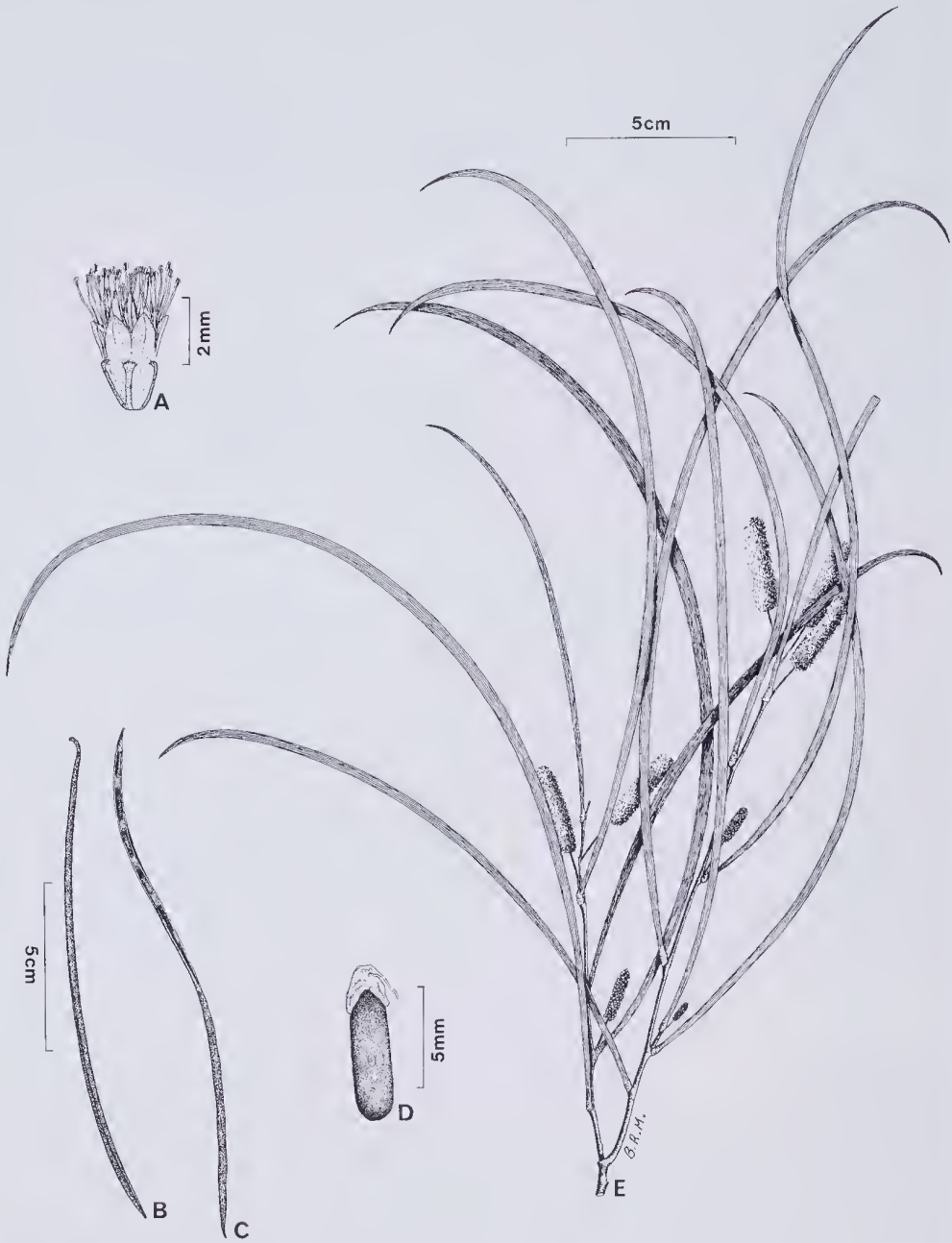

Figure 1. *Acacia anastema*. A—Flower. B—Legume (undehisced). C—Legume valve. D—Seed. E—Portion of branch.

A, E from *B. R. Maslin* 5004 (the type); B—D from *A. Holmes* s.n.

More or less obconic *trees* to 6 m tall, with a single trunk or sometimes 2(3) branched at ground level. *Juvenile plants* single- or multi-stemmed with straight, erect trunks, habit sometimes conifer-like with more or less horizontal branches diverging from the main trunk(s). *Bark* grey and fibrous, longitudinally fissured on main trunks but smooth on branches. *Branchlets* terete, finely ribbed (ribs slightly resinous when very young), dark grey and glabrous except towards their apices where they may be reddish brown and hoary between the ribs (hairs golden when very young). *New shoots* pale citron-sericeous and slightly resinous. *Stipules* widely deltate, c. 1 mm long, somewhat persistent, brown. *Phyllodes* linear but gently tapered to delicately curved and non-pungent apices, (11)15-25(32) cm long, 2-6 mm wide, length to width ratio 30-95, spreading, falcate, not rigid, hoary when young, hairs becoming restricted to between the nerves with age, greyish green or pale green; *nerves* very fine and close together, uniform or sometimes the midrib and a nerve on either side of it slightly more evident than the rest; *pulvinus* 1 mm long, slightly dilated at the base, transversely wrinkled, yellowish, resinous when young; *gland* obscure, situated at the distal end of the pulvinus within a shallow depression formed by the bifurcation of the adaxial marginal nerve, submerged within and surrounded by a swelling of the lamina, lip yellowish but not raised, orifice absent. *Inflorescence* a simple, axillary pedunculate spike, the peduncles 1-2 per node and often arising from the base of new shoots. *Peduncles* 1-2 cm long, resinous-strigillose, hairs white or golden; *basal peduncular bracts* sub-persistent, ovate, c. 1 mm long, concave, brown. *Spikes* bright golden, 2-4 cm long and to 8 mm wide at anthesis, flowers densely arranged. *Bracteoles* sub-peltate, 1 mm long; *claws* linear; *laminae* incurved, thickened, dark brown and sparsely ciliolate. *Flowers* 5-merous. *Sepals* 1/2 the length of the petals, free or united at their extreme base; *claws* glabrous, linear to narrowly oblong; *laminae* inflexed, often brown, sparsely ciliolate otherwise glabrous. *Petals* 2.5-3 mm long, connate for 2/3 their length, very obscurely 1-nerved, glabrous, granulose along margin at the apex, apices often inrolled when dry. *Ovary* densely white villose. *Legumes* linear-terete, very slightly constricted between the seeds, to 14 cm long, 2-3 mm wide, slightly chartaceous to somewhat crustaceous, straight to slightly curved, valves often twisted or shallowly curved to shallowly sinuous following dehiscence, light brown, glabrous or sparsely hoary, margins not thickened, constricted at apex into a bluntly acute point. *Seeds* longitudinally placed in the legumes, shortly cylindrical, 5-5.5 mm long, 2-3 mm wide, 1.5 mm thick, brown to greyish brown, somewhat shiny, possessing an obscure, depressed, peripheral line; *pleurogram* very obscure, open towards the hilum; *areole* 0.4-0.6 mm long, 0.2-0.3 mm wide; *funicle* filiform, expanded into a convoluted *aril*.

Other specimens examined. WESTERN AUSTRALIA: 29.3 mi (47 km) S of Gascoyne Junction, *A. M. Ashby* 4610 (AD, CBG, PERTH); Woodleigh Station, *H. Demarz* D3329 (KP, PERTH); Ellavalla Station, *H. Demarz* 5184 (KP, PERTH); Marron Station, 28 Nov. 1980, *A. Holmes* s.n. (PERTH); 35 km S of Gascoyne Junction on the road to Towrana Station, *B. R. Maslin* 5004A (PERTH); 47 km E of North West Coastal Highway on the Woodleigh Station-Yalardy Station road, *B. R. Maslin* 5163 (PERTH).

Distribution. (Figure 14) Appears mainly confined to the Yabalgo Plain (Beard 1976) in the southern part of the Carnarvon Botanical District between Woodleigh Station (26°11'S, 114°33'E) and Ellavalla Station (25°05'S, 114°23'E)-1:250 000 maps G50-5,9.

Habitat. Confined to red sand dunes where it frequently forms pure stands. Towards the southern limit of its distribution, on Woodleigh Station, the species occurs in association with *Acacia ramulosa* W. V. Fitzg., *A. sclerosperma* F. Muell. and *A. tetragonophylla* F. Muell.

Flowering and fruiting period. Flowers from late July to September. Mature legumes have been collected in late November.

On account of its spicate inflorescences and its multinerved phyllodes the species is placed in section Juliflorae (Benth.) Maiden et Betche. Using Bentham's (1864) classification *A. anastema* is placed in series Juliflorae subseries Falcatae where it occurs in the *A. doratoxylon* A. Cunn. group. This is a large, Australia-wide species-complex which includes, among other species, *A. lasiocalyx* C. Andrews to which *A. anastema* seems most closely related. Both these species grow to small trees, possess long, finely multistriate phyllodes and have rather dense, showy spikes. *Acacia lasiocalyx* is distinguished by its united sepals and flat, broad legumes (to 5 mm wide). The two species do not occur sympatrically. Except for being much longer, the legumes of *A. anastema* are very similar to those of *A. coolgardiensis* Maiden but the former is recognized by its shorter, often terete phyllodes, its sessile, shorter spikes, its smaller seeds and its fluted trunks.

The specific epithet refers to the tall growth habit.

2. **Acacia distans** Maslin, sp. nov. (Figures 3 and 4)

Arbor 5-8 m altus. *Phyllodia* angustissime elliptica, acuminata, plerumque 6-11 cm longa, 4-10(11.5) mm lata, modice falcata, multistriata, dense appresse in statu juvenili puberula. *Spicae* ad 11 cm longae, 4-5 mm latae, floribus ad 130 in fasciculis distantibus. *Flores* 5-meri. *Calyx* cupularis. *Legumina* (in statu submaturo) linearia, ad 9.5 cm longa, 3-5 mm lata. *Semina* (immatura) in legumine longitudinalia, obloidea.

Typus: Gascoyne River crossing, 3 km S of Landor Station homestead, Western Australia. "Tree to 8 m tall, more or less infundibular with dense, silvery grey-green, slightly rounded crowns. Bark dark grey, longitudinally fissured with fine horizontal fissures on the individual segments. New shoots at first pale citron-sericeous, then turning silvery light green. Ultimate branchlets very slender, sometimes pendulous. Phyllode apices brown and acute, not pungent. Forming dense, almost monotypic stands along the banks of the River. A little *Acacia citrinoviridis* growing here also." 7 May 1982, *B. R. Maslin* 5183 (holo: PERTH; iso: BRI, CANB, K, MEL, NSW, NY).

Trees 5-8 m tall, normally more or less obconic with dense, bushy, more or less rounded, silvery grey-green crowns, either with a single trunk or sparingly divided near ground level, trunks to c. 40 cm diam. at base. *Bark* medium or dark grey to almost black, finely longitudinally fissured on main trunks with the individual segments marked with fine horizontal fractures (Figure 4B), smooth on branches. *Branchlets* slender and sometimes pendulous, terete, very obscurely nerved, glabrous and grey to red-brown except on new shoots where they are light brown and frequently strigillose. *New shoots* at first with densely citron-sericeous phyllodes, with age the hairs turning white and the phyllodes becoming silvery light green. *Stipules* deciduous. *Phyllodes* linear or broadest near the middle, tapering to acute, brown, non-pungent points, 6-11 cm long (rarely longer), 4-10(11.5) mm wide, length to

Figure 2. ***Acacia anastema***. Photograph of *B. R. Maslin* 5004 (the type).

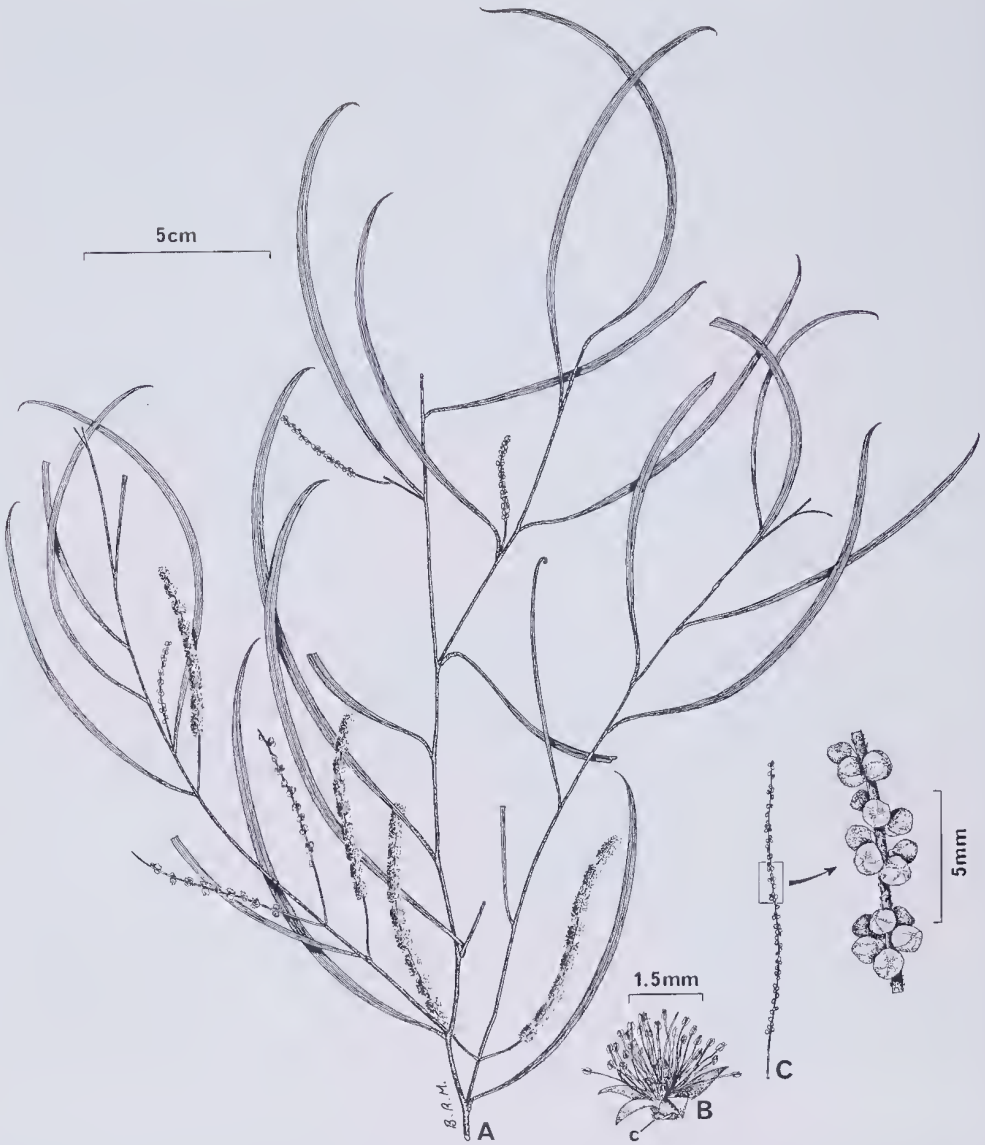

Figure 3. *Acacia distans*. A—Portion of branch. B—Flower showing small, cupular calyx (c) and widely spreading petals. C—Spike with enlargement showing flowers arranged in more or less distant clusters.
A from *B. R. Maslin* 5183 (the type); B—C from *L. Glauert* s.n.

width ratio 9-21, gently falcate, not rigid, densely hoary with appressed hairs when young, indumentum sparser with age; *nerves* fine, numerous and close together, parallel and not anastomosing, interstices 0.1-0.2 mm wide, the central nerve and sometimes one on either side of it slightly more evident than the rest, the nerves frequently obscured by the dense indumentum especially on young phyllodes; *pulvinus* orange, 2-3 mm long, finely transversely wrinkled; *gland* on the upper margin of the phyllodes 1-2 mm above the pulvinus, very obscure, less than 0.5 mm long, lamina

slightly swollen about the gland. *Inflorescence* normally an extremely reduced, 2(3)-branched raceme of pedunculate spikes, rarely seemingly simple, the raceme axes minute (0.5-1 mm long) and frequently growing out at apex into a leafy shoot. *Peduncles* 8-12 mm long, antrorsely white puberulous; *basal peduncular bracts* caducous. *Spikes* to 11 cm long, 4-5 mm wide, with up to 130 small flowers arranged in more or less distant clusters along the antrorsely puberulous receptacles (hairs sometimes sparse). *Bracteoles* subsessile, the inflexed laminae ovate, acute, c. 0.3 mm long, dark brown and densely puberulous abaxially. *Flowers* 5-merous but on some occasionally 6 petals. *Calyx* small and cupular, 1/5-1/6 the length of the corolla, membranous, puberulous, divided for about 1/2 its length into broadly triangular lobes. *Petals* 1.7 mm long, free almost to their base, spreading widely at anthesis, sparsely puberulous, very obscurely 1-nerved. *Ovary* densely white-tomentose. *Legumes* (slightly immature) linear but slightly raised over and shallowly constricted between the seeds (?moniliform at maturity), to 9.5 cm long, 3-5 mm wide, somewhat crustaceous, obscurely longitudinally nerved, reddish brown, densely hoary when young but indumentum sparser with age. *Seeds* (immature) longitudinally placed in the legume, obloid; *funicle* minute (0.3 mm long) and linear, expanded into a small, convoluted *aril*.

Other specimens examined. WESTERN AUSTRALIA: Mount Narryer Station, *G. E. Brockway* 1 (PERTH); The Dale Paddock, Towera Station, 23°22′S, 114°58′E, *R. J. Cranfield* 1749a (MEL, PERTH); Murchison River, May 1922, *L. Glauert* s.n. (PERTH); Mileura Station, *J. Kruiskamp* 4096 and 4100 (both PERTH); 16 km from Byro homestead on the road to Milly Milly Station, *B. R. Maslin* 5174 (BRI, MEL, PERTH); Beringarra, *N. H. Speck* 656 (BRI, MEL, PERTH); 12 mi (19 km) N of Mileura homestead, *N. H. Speck* 970 (K, NSW, PERTH).

Distribution. (Figure 14) Of scattered occurrence between the Murchison and Ashburton rivers from Mileura Station (26°22′S, 117°20′E) in the north-west Austin Botanical District to Towera Station (23°22′S, 114°58′E) in the extreme north-west of the Ashburton Botanical District (1:250 000 maps G50-6, 10, 11; F50-13).

Habitat. Principally confined to low-lying, loamy, alluvial plains where it often forms almost pure stands.

Flowering and fruiting period. Flowering from late March until May. Legumes with immature seeds have been collected between July and September.

On account of its spicate inflorescences and its multinerved phyllodes the species is placed in section Juliflorae (Benth.) Maiden et Betche. In its growth habit and greyish foliage *A. distans* may be mistaken in the field as a broad phyllode form of Mulga (*A. aneura* F. Muell. ex Benth.) or River Jam (*A. citrinoviridis* Tindale et Maslin), however, the new species is at once recognized by its very long spikes bearing numerous small flowers arranged in rather well-spaced clusters, and by its long, linear legumes.

The specific epithet refers to the spikes with their well-spaced flowers.

3. **Acacia drepanophylla** Maslin, sp. nov. (Figures 5 and 6)

Arbuscula 2.5-4(5) m alta. *Rami* glabri. *Phyllodia* linearia, acuminata, falcata, patentia, (9)15-20 cm longa, 3-6 mm lata, multistriata. *Pedunculi* 1-3 mm longi. *Spicae* 15 mm longae et 5 mm latae (in sicco). *Flores* 4-meri. *Sepala* libera. *Legumina* late linearia, ad 11.5 cm longa, 8-11 mm lata, supra semina umbonata. *Semina* in legumine longitudinalia ad obliqua, applanata, circularia, 5-6 mm diam.

Figure 4. *Acacia distans*. A—Community showing pure stand. B—Bark showing longitudinal fissures and fine horizontal fractures.

Both of *B. R. Maslin* 5183 (the type).

Typus: 25.5 km N of Overlander Roadhouse on North West Coastal Highway, Western Australia. "Dense spreading tree c. 3 m tall; bark ±light grey, fissured at base of trunk otherwise smooth; flower-heads light yellow; phyllodes ±light green, curved. On stony plain with *A. tetragonophylla* and *A. grasbyi*." 16 June 1972, *B. R. Maslin* 2778 (holo: PERTH; iso: AD, B, BRI, MO, RSA—distributed as *Acacia oldfieldii*).

Small more or less obconic *trees* 2.5-4(5) m tall, with a single trunk or sparingly divided at ground level, crowns not particularly dense. *Bark* grey, fibrous, longitudinally fissured on main trunks but smooth on the branches which are apically reddish

brown. *Branchlets* terete, very obscurely ribbed, glabrous and with a light grey and often longitudinally fissured epidermis over a reddish brown undersurface, lenticels scattered. *New shoots* with pale citron-sericeous phyllodes on reddish brown, antrorsely puberulous axes. *Stipules* deciduous. *Phyllodes* linear although tapered towards their apices into delicate, acuminate, slightly curved, non-pungent points, (9)15-20 cm long, 3-6 mm wide, length to width ratio 30-65, characteristically spreading and gently falcate, light green, not rigid, glabrous or sparsely strigillose; *nerves* numerous and close together, parallel and not anastomosing, fine although slightly raised when dry, midrib and sometimes a nerve on either side of it slightly more evident than the rest, marginal nerves yellowish but not pronounced; *pulvinus* 1.5-2 mm long, slightly dilated at base, tranversely rugose, greenish yellow but often brownish when dry; *gland* on the upper margin of the phyllode at the distal end of the pulvinus, circular, 0.5 mm diam., lip yellowish and slightly raised and surrounding a shallow central orifice. *Inflorescence* an extremely reduced raceme of 2, shortly pedunculate spikes, the raceme axes less than 0.5 mm long, new shoots frequently developing from within the axil of the peduncles. *Peduncles* 1-3 mm long, white puberulous but hairs often sparse; *basal peduncular bracts* deciduous, ovate, about 2 mm long and 2 mm wide, concave, brown, apically cleft. *Spikes* light yellow, about 15 mm long and 5 mm wide at anthesis (when dry); *receptacles* rather sparsely pale golden puberulous to glabrescent. *Bracteoles* about 1 mm long, claws linear and glabrescent; *laminae* incurved, relatively large (0.5 mm diam.), ovate, dark brown, concave, slightly thickened and puberulous. *Flowers* 4-merous. *Sepals* 3/4-7/8 the length of the petals, free, linear-spathulate, claws glabrous or glabrescent; *laminae* concave, slightly thickened, dark brown and rather sparsely puberulous (hairs pale golden or white and often restricted to the margins). *Petals* connate for about 3/4 their length, 1.5-2 mm long, glabrous, apically dark coloured, very obscurely 1-nerved. *Legumes* broad-linear, shallowly constricted between the seeds, to 11.5 cm long, 8-11 mm wide, straight to slightly curved, firmly chartaceous to slightly coriaceous, flat but obviously raised over the seeds, light brown (greyish brown prior to maturity) but the circular umbos slightly darker than the intervening spaces between the seeds, glabrous, sparingly openly reticulate, narrowed into somewhat uncinate apices, margins slightly thickened. *Seeds* longitudinally to obliquely placed in the legumes, remaining attached to the legume following dehiscence, compressed-globose (c. 2-3 mm thick), 5-6 mm diam., greyish brown, dull; pleurogram very obscure, widely "u"-shaped and open towards the hilum; *areole* 0.5-0.7 mm long, 0.8 mm wide; *funicle* membranous, flattened and convoluted, about 4 mm long, pale cream, reflexed below a small flattened *aril*.

Other specimens examined. WESTERN AUSTRALIA: Carnarvon road, 501 mile peg, *A. M. Ashby* 3833, comm. G. Phillips, (PERTH); 501 mile peg, North West Coastal Highway, *A. M. Ashby* 4582 (PERTH); North West Coastal Highway, *A. M. Ashby* 5334 (PERTH); Coburn Station, *J. S. Beard* 7398 (PERTH); Yaringa Station, about halfway between Geraldton and Carnarvon, *W. E. Blackall* 4702 (PERTH); Near Overlander Roadhouse on North West Coastal Highway, 2 July 1982, *P. W. Hennig* s.n. (K, MEL, NSW, PERTH); 125 km N of the Murchison River on North West Costal Coastal Highway, *B. R. Maslin* 2631 (PERTH); Hamelin Pool Station, c. 26 km W of Overlander [Roadhouse], *B. R. Maslin* 3655 and 3656 (both PERTH); 10 km N of Overlander Roadhouse, North West Coastal Highway, *B. R. Maslin* 4320 and 4321 (both PERTH); 3.5 km S of Billabong Roadhouse on North West Coastal Highway, *B. R. Maslin* 4987 (PERTH); 4 km N of Overlander Roadhouse, North West Coastal Highway, *B. R. Maslin* 4992 (CANB, PERTH); Hamelin Pool Road, W of Overlander Roadhouse, *A. S. Weston* 6891 (CANB, PERTH).

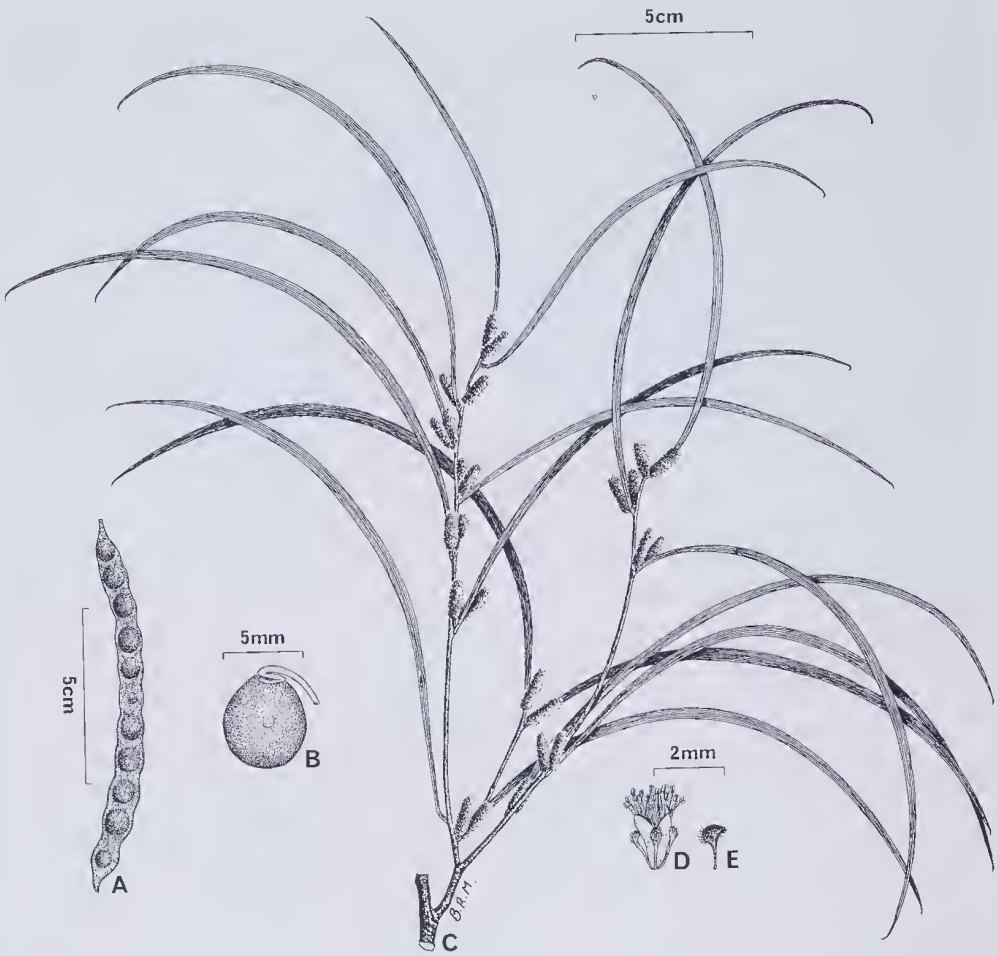

Figure 5. *Acacia drepanophylla*. A—Legume. B—Seed. C—Portion of branch. D—Flower (4-merous). E—Bracteole showing large, dark brown lamina.
A—B from *A. M. Ashby* 3833 (comm. G. Phillips); C—E from *B. R. Maslin* 2778 (the type).

Distribution. (Figure 14) Western Australia in the southern part of the Carnarvon Botanical District (1:250 000 maps G50-5, 9). Restricted to the vicinity of Shark Bay from Wannoo (26°49′S, 114°37′E) to Yaringa Station (25°56′S, 114°19′E). Very common throughout its range.

Habitat. Shallow red clay or loam over limestone in flat to low-undulating country in dense *Acacia* scrub with *A. grasbyi* Maiden, *A. ramulosa* W. V. Fitzg., *A. sclerosperma* F. Muell., *A. victoriae* Benth. and *A. xiphophylla* E. Pritzel. In places, for example around the Overlander Roadhouse (26°25′S, 114°28′E), *A. drepanophylla* is the dominant element within the vegetation. Its limits of distribution appear to be determined, at least in part, by soil depth. For example, near Woodleigh Station (26°11′S, 114°33′E) where soils are deep, *A. drepanophylla* does not grow, however, west of this locality in what seems to be the same vegetation, the species is common on shallow soil over limestone.

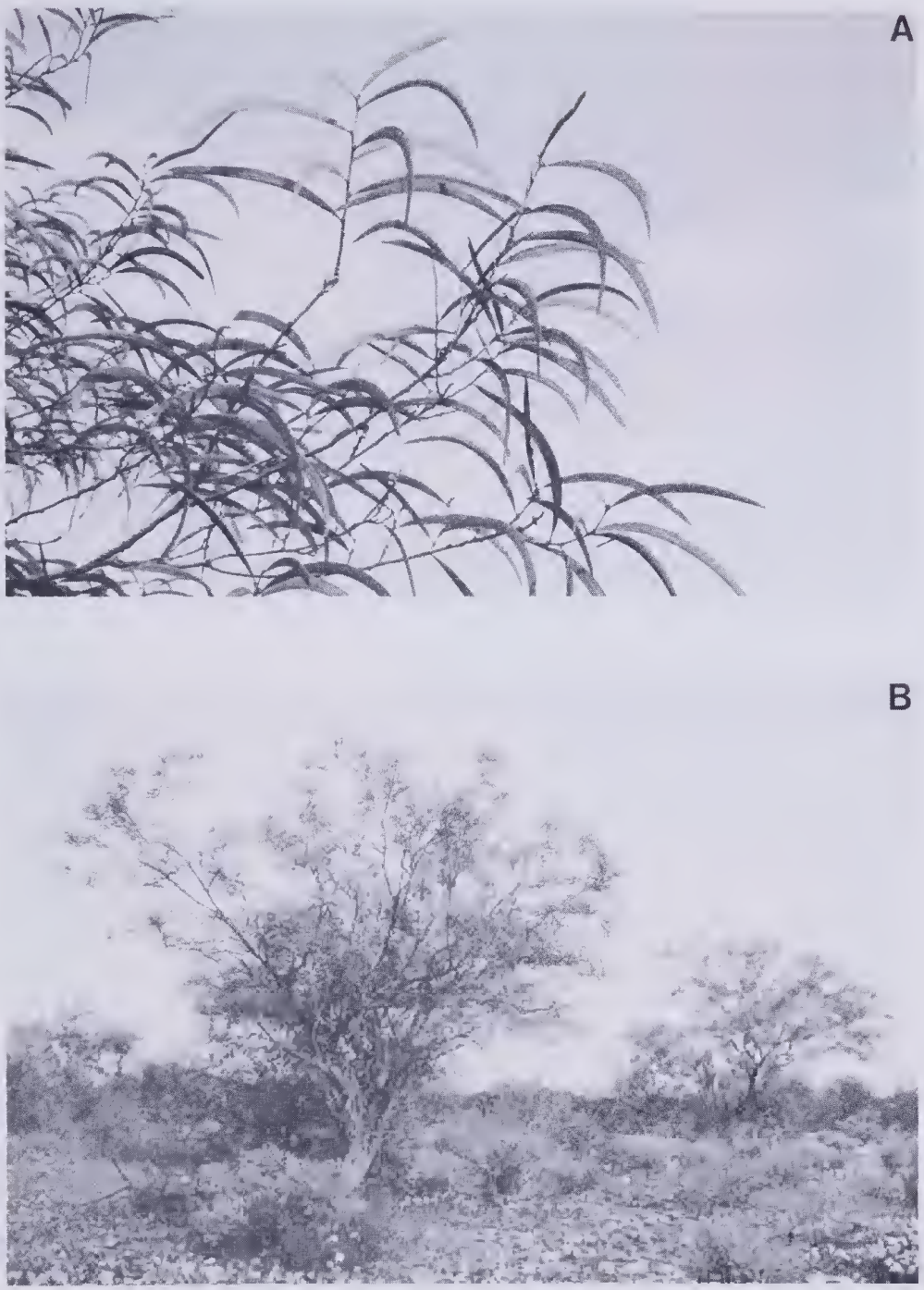

Figure 6. *Acacia drepanophylla*. A—Upper portion of branch showing characteristically falcate, spreading phyllodes. B—Growth habit.
Both of *B. R. Maslin* 4992.

Flowering and fruiting period. Flowering from May to July. Mature legumes have been collected in November.

On account of its multinerved phyllodes and its spicate inflorescences *A. drepanophylla* is placed in section Juliflorae (Benth.) Maiden et Betche where, because of its acuminate phyllodes, short peduncles and 4-merous flowers, it seems most closely allied to *A. oldfieldii* F. Muell. *Acacia drepanophylla* is, however, readily distinguished by its longer, falcate phyllodes, paler yellow spikes, free sepals and broader legumes. In its growth habit and its spreading, falcate phyllodes the new species resembles *A. subtessarogona* Tindale et Maslin (1976) but is distinguished by its longer spikes, non-quadrangular legumes and green, glabrous phyllodes.

The specific epithet refers to the characteristically falcate phyllodes (see Figure 6A).

4. **Acacia galeata** Maslin, sp. nov. (Figures 7 and 8)

Frutex vel *arbuscula* plerumque ad 6 m alta. *Phyllodia* anguste elliptica ad lanceolata, 6-11 cm longa, 6-15 mm lata, ±glabra, 2-3(4) nervata, acuminata; *pulvinus* 3-6 mm longus. *Racemi* 3-5-ramosi. *Pedunculi* 4-7 mm longi. *Capitula* globosa, 35-45-flora. *Flores* 4-meri. *Legumina* submoniliformia, ad 18 cm longa, 7-8 mm lata. *Semina* in legumine longitudinalia, obloideo-ovoidea, ad 7.5 mm longa et 5 mm lata; *arillus* magnus, cucullatus, aurantiacus.

Typus: 12 km N of the Woodleigh turn-off on North West Coastal Highway, Western Australia. "Bushy young shrubs. Older trees were sterile." 2 July 1982, *P. W. Hennig* s.n. (holo: PERTH; iso: CANB, K, MEL, NY).

Bushy, rounded shrubs growing to small *trees* 5-6 m tall with rather dense crowns and 1-2 main trunks, wind-pruned to c. 1-1.5 m tall in some coastal situations. *Bark* grey, fibrous and longitudinally fissured on main trunks, smooth on branches. *New shoots* at first densely citron-sericeous but indumentum soon turning white and phyllodes light green. *Branchlets* terete, very obscurely nerved, glabrous except when young, apically yellow or pale orange. *Stipules* deciduous. *Phyllodes* narrowly elliptic to lanceolate, the adaxial margin often slightly more convex than the abaxial margin, 6-11 cm long, 6-15 mm wide, length to width ratio 4.5-13, straight or slightly falcate, not rigid, rather widely spreading, glabrous to glabrescent, rather glaucous; *apices* acuminate, not pungent, straight or gently curved; *pulvinus* distinct, 3-6 mm long, pale orange, finely wrinkled; *longitudinal nerves* 2-3(4), well-spaced, not basally confluent with the margins, obscure and impressed when fresh but slightly raised and frequently yellowish when dry, intervening venules submerged, very obscure (obscure at x10 mag. when dry) and forming a close longitudinal reticulum; *gland* on adaxial margin of the phyllode at, or just above, the distal end of the pulvinus, often not prominent, 0.2-0.6 mm diam., generally comprising yellowish or brown nectiferous tissue without a central orifice, margin normally slightly swollen about the gland. *Inflorescence* an extremely reduced raceme of 3-5 pedunculate flower-heads appearing as axillary fascicles, raceme axes 1-1.5 mm long and often growing out as a leafy shoot. *Peduncles* 4-7 mm long, sparsely to densely strigillose; *basal peduncular bract* semi-deciduous, elliptic, concave, c. 1.5 mm long, dark brown, slightly auriculate, densely fimbriate especially near the base. *Flower-heads* bright golden, fragrant, globular, 4-5 mm diam. when dry, with c. 35-45 rather densely arranged flowers. *Bracteoles* c. 1 mm long, linear-spathulate; *laminae* slightly keeled, dark brown and densely puberulous abaxially (hairs white or pale golden). *Flowers* 4-

Figure 7. *Acacia galeata*. A—Portion of branch. B—Node showing 5-branched condensed raceme and base of phyllode with long pulvinus (p) and 3 principal longitudinal nerves (intervening venules submerged). C—Legume (dehisced). D—Seed showing obscure peripheral ridge and prominent, hood-shaped aril. A from *P. W. Hennig* s.n. (the type); B from *J. S. Beard* 7400; C—D from *A. L. Payne* 41.

merous. *Calyx* c. 1/2 the length of the corolla, dissected for about 1/2 its length but readily splitting to the base into oblong-spathulate sepals, frequently dark brown when dry, apically pale golden puberulous with the hairs frequently restricted to the apical margins. *Petals* c. 2 mm long, connate for c. 1/2 their length, glabrous but margins (free portion) minutely granulate, nerveless. *Ovary* densely white villous. *Legumes* submoniliform (prominently raised over seeds but often only slightly constricted between them), to 18 cm long, 7-8 mm wide, coriaceous to sub-woody, dark

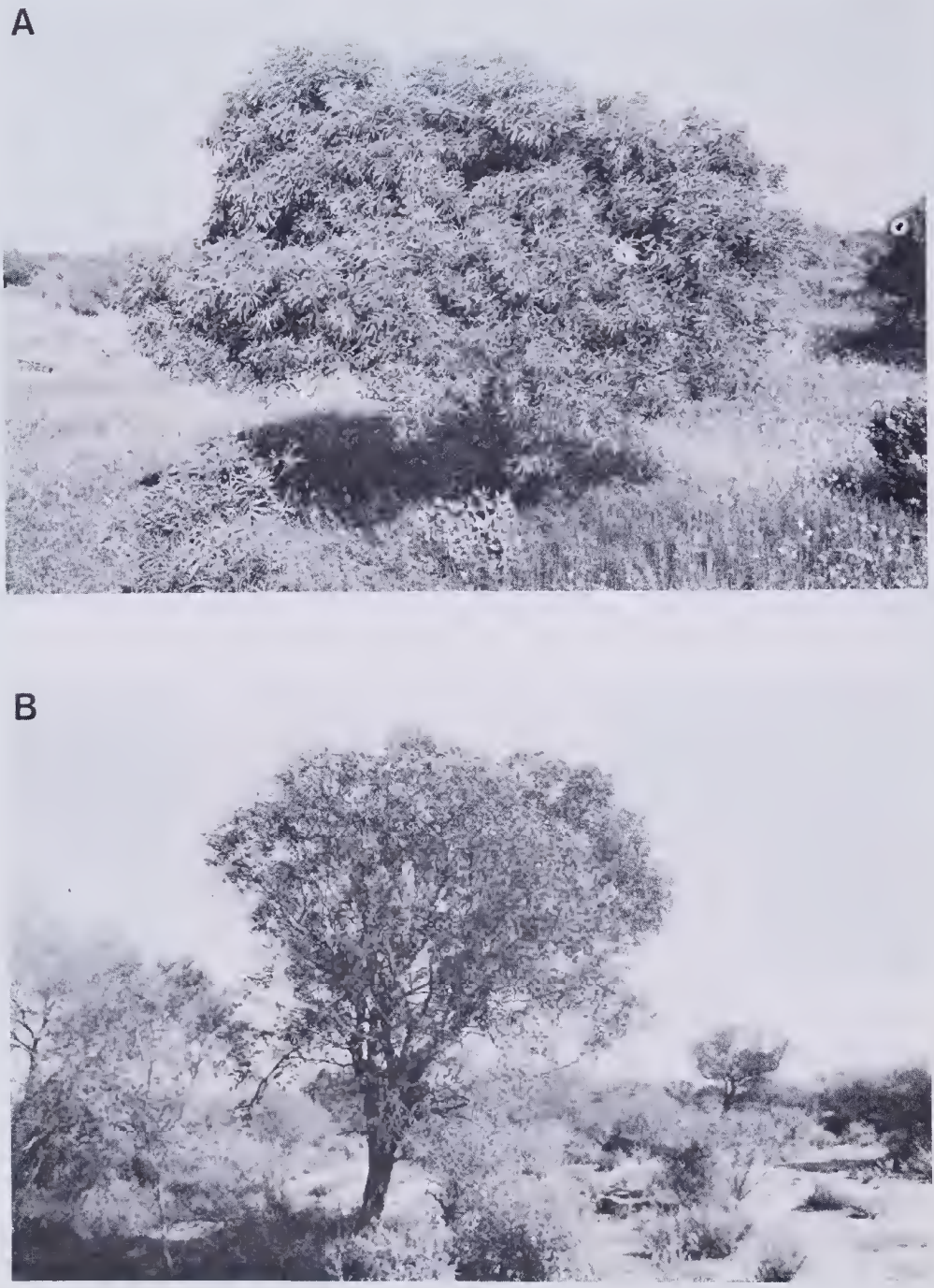

Figure 8. *Acacia galeata*. A—Young shrub (of *B. R. Maslin* 3657); B—Mature tree (of *B. R. Maslin* 4989).

brownish over seeds, yellow between seeds, glabrous, not reticulate, apex acute, margins not thickened. *Seeds* longitudinally placed in the legume, obloid-ovoid, turgid, to 7.5 mm long and 5 mm wide, with an obscure peripheral ridge, dark greyish brown, sub-shiny; *pleurogram* obscure, elongated "u"-shaped, open towards the hilum; *areole* c. 2.5 mm long and 1 mm wide, areolar area slightly paler colour than rest of seed; *funicle* very short; *aril* orange, fleshy, very large and hood-shaped, extending almost wholly down one side of the seed and sheathing about 1/2 its surface area.

Other specimens examined. WESTERN AUSTRALIA: About 9.5 mi (15 km) S of Billabong Service Station on North West Coastal Highway, *A. M. Ashby* 4739 (AD, PERTH); Nerren Nerren [Station], near the homestead, *J. S. Beard* 7400 (PERTH); Dirk Hartog Island, April 1974, *Trevor Evans* s.n. (PERTH); About 5.5 km N of Herald Bay outcamp, Dirk Hartog Island, 25°48′S, 113°05′E, *A. S. George* 11510 (PERTH); Monkey Mia, Peron Peninsula, *K. F. Kenneally* 1335 (PERTH); North of Quoin Bluff, Dorre Island, 25°00′S, 113°07′E, *K. F. Kenneally* 4652 (PERTH); 125 km S of Carnarvon towards Geraldton, North West Coastal Highway, *B. R. Maslin* 2772 (BRI, CBG, MEL, NSW, NY, PERTH); 39.5 km S of Overlander Roadhouse on North West Coastal Highway, *B. R. Maslin* 2781 (CANB, K, PERTH); Hamelin Pool Station, c. 26 km W of Overlander [Roadhouse], *B. R. Maslin* 3657 (PERTH); 9 km N of Billabong Roadhouse on North West Coastal Highway, *B. R. Maslin* 4989 and 5161 (both PERTH); Shark Bay, Voyage on H.M.S. Herald, *Milne* s.n. (K); Wooramel Station, *A. L. Payne* 41 (PERTH); Dorre Island, Shark Bay, *R. D. Royce* 5952 (PERTH); Hamelin Station, on Denham road about 8 km E of homestead, 23 Nov. 1981, *J. Stretch* s.n. (PERTH); Denham, Shark Bay, June 1957, *J. Wareham* s.n. (PERTH); Quoin Bluff, Dorre Island, *A. S. Weston* 10604 (PERTH, TLF).

Distribution. (Figure 14) Western Australia in the southern part of the Carnarvon Botanical District (1:250,000 maps G49-8; G50-5, 9, 13). Restricted to the Shark Bay area where, on the mainland, it occurs from Nerren Nerren Station (27°08′S, 114°38′E) north to Wooramel Station (25°44′S, 114°17′E) and north-east to the Peron Peninsula around Denham (25°56′S, 113°32′E). The species has also been recorded from two nearby off-shore islands, viz. Dirk Hartog Island (c. 26°S, 113°E) and Dorre Island (c. 25°S, 113°E).

Habitat. Sand or loam over limestone. In near-coastal areas, *A. galeata* has been recorded from tall open-heath (Burbidge and George 1978:79—the species there referred to as *Acacia* sp.). Further inland it occurs in York Gum woodland or tall shrubland in association with *A. drepanophylla* Maslin, *A. sclerosperma* F. Muell. and *A. wiseana* C. A. Gardner.

Flowering and fruiting period. Flowers from April to June. Legumes with mature seeds have been collected in both April and November at which times very young inflorescence buds were also present on the plants. The indications are that it takes about 9-10 months for seed to mature following anthesis.

On account of its plurinerved phyllodes and globular flower-heads, *A. galeata* is placed in section Plurinerves (Benth.) Maiden et Betche but does not appear closely related to the other members of this group. The species is very distinctive in its 2-3(4)-nerved phyllodes (interstices closely reticulate), reduced axillary racemes, 4-merous flowers, submoniliform legumes and large, orange, hood-shaped arils. In its growth habit and phyllode shape and colour it superficially resembles *A. microbotrya*

Benth. (section Phyllodineae DC.), however, the two species are not closely related. *Acacia microbotrya* has 1-nerved phyllodes, elongated racemes, 5-merous flowers and filiform, cream funicles which encircle the seeds in a double fold before expanding into a short, clavate aril.

The specific epithet refers to the prominent, hood-shaped aril.

5. **Acacia intorta** Maslin, sp. nov. (Figures 9 and 10)

Frutex vel *arbor* 2-3 m altus, habitu *A. xiphophyllae* ('Snakewood'). *Phyllodia* plerumque acicularia, (4)5-10(12.5) cm longa, 1.5-2(4) mm lata, rigida, stricta, multistriata. *Pedunculi* (3)5-15(20) cm longi. *Spicae* 1-3.5(5) cm longae, floribus laxe dispositis. *Flores* 5-meri. *Calyx* gamosepalus. *Legumina* (in statu submaturo) anguste oblonga, 4-9 cm longa, 5-8 mm lata, glabra. *Semina* in legumine longitudinalia, obloidea, ad 7 mm longa et 5 mm lata; *funiculus-arillus* clavatus.

Typus: 30 km N of Tangadee homestead, Western Australia. "Tall shrub (3m tall) growing on shaley rise. Sharp terete phyllodes. Plant has similar habit to *Acacia xiphophylla*. Common on Mt. Vernon and Tangadee stations." 16 Oct. 1976, *A.A. Mitchell* 283 (holo: PERTH; iso: CANB, K, MEL, PERTH).

Rather gnarled *shrubs* 2-3 m tall and to 6 m diam., normally 2-4-branched near ground level, branches rather contorted and normally spreading horizontally (occasionally along the ground—Figure 10B). *Bark* grey, fibrous and longitudinally fissured on trunks and main branches but smooth towards the ends of the branches. *Branchlets* terete, very obscurely ribbed, grey and glabrous except at extreme apices where they are brown and sometimes sparsely strigillose. *Stipules* deciduous. *Phyllodes* acicular, very rarely broad-linear, (4)5-10(12.5) cm long, 1.5-2(4) mm wide, terete or sometimes subterete, very rarely flat, ascending, rigid, straight, glabrous or sometimes glabrescent near the base, subglaucous or sometimes pale green, very glaucous on juvenile phyllodes of young plants, finely multistriate with submerged obscure *nerves*; *apices* sharply pungent, brown; *pulvinus* 2 mm long, slightly dilated at the base, obscurely wrinkled, yellowish or orange; *glands* obscure, up to 4 on adaxial surface of the phyllode, the basal gland 0.5-3 mm above the pulvinus, orifice slit-like, lip yellowish and barely raised above the surface of lamina. *Inflorescence* an extremely reduced raceme of 1(2) pedunculate spikes, raceme axes c. 0.2 mm long and often growing out into a leafy shoot. *Peduncles* (3)5-15(20) mm long, glabrous or sparsely puberulous, subtended by a deciduous, broadly ovate, brown, clasping basal bract c. 2 mm long. *Spikes* 1-3.5(5) cm long, flowers not very densely arranged; *receptacles* sparsely white-puberulous but glabrous with age. *Bracteoles* spathulate, c. 1 mm long, light brown, claws 0.5 mm long and expanded into elliptic, concave laminae which are puberulous abaxially (hairs both white and golden). *Flowers* 5-merous. *Calyx* 1/3-1/2 the length of the corolla, gamosepalous, more or less truncate or divided for c. 1/4 its length into triangular lobes, tube puberulous or glabrescent (hairs as on bracteoles). *Petals* c. 2 mm long, glabrous or glabrescent, very obscurely 1-nerved. *Legumes* (slightly immature) narrowly oblong, of variable size (see discussion below), 4-9 cm long and 5-8 mm wide, straight or slightly curved, firmly chartaceous, raised over seeds but not or only slightly constricted between them, brown, glabrous, sparsely and openly longitudinally reticulate, apex acute, basal stipe 3-5 mm long; margins narrow, slightly thickened, yellowish. *Seeds* (slightly immature) longitudinally placed in the legume, obloid, of variable size (see discussion below), 4-

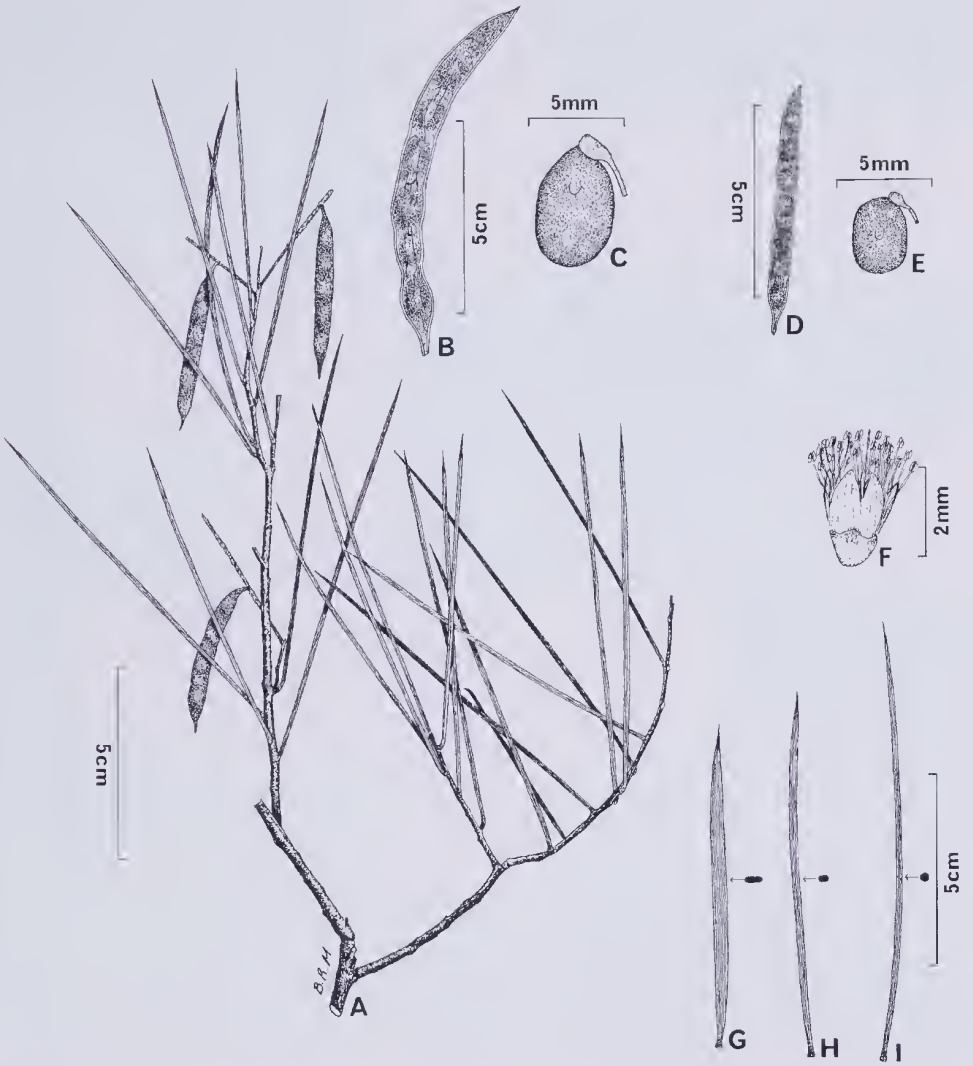

Figure 9. *Acacia intorta*. A—Portion of branch showing fruiting spikes. B—Legume. C—Seed. D—Legume. E—Seed. F—Flower. G—I—Phyllodes showing width variation, tranverse section (slightly enlarged) given in silhouette (G—flat phyllode, very rare; H—subterete phyllode, not very common; I—terete phyllode, normal).

A, D—E, I from *A. A. Mitchell* 283 (the type); B—C from *J. S. Beard* 6113; F, H from *B. R. Maslin* 5282; G from *B. R. Maslin* 5286.

7 mm long and 3-5 mm wide, somewhat compressed, to 2.5 mm thick, to 9 seeds per legume, dark brown; *pleurogram* obscure, "u"-shaped and open towards the hilum; *areole* 0.6 mm long and 0.5 mm wide; *funicle-aril* small, clavate and unfolded, extending down c. 1/3 the length of the seed.

Other specimens examined. WESTERN AUSTRALIA: Mt Vernon, 17 mi (27 km) NW of homestead, *J. S. Beard* 6113 (PERTH); Bulloo Downs Station, near Ilgarari Outcamp at E end of Lofty Range, *B. R. Maslin* 5282 (BRI, PERTH); Tangadee

Station, about 10 km NE of homestead on the track to Ilgarari Outcamp (Bulloo Downs Station), *B. R. Maslin* 5286 (CANB, PERTH); Mount Vernon Station, *A. A. Mitchell* 235 (PERTH); 20 km N of Bulloo Downs homestead, *A. A. Mitchell* 300 (CANB, MEL, PERTH); 20 km E of Bulloo Downs homestead, *A. A. Mitchell* 300A (PERTH); Meekatharra to Bulloo Downs road, Bulloo Downs, 15 June 1976, no collector given (PERTH).

Distribution. (Figure 14) Western Australia in the Ashburton Botanical District (1:250 000 maps F50-16; G50-3, 4). Confined to the drainage system in the upper reaches of the Ashburton River between Bulloo Downs Station (24°00'S, 119°34'E) and Mount Vernon Station (24°14'S, 118°14'E). The species is not uncommon throughout its range.

Habitat. Occurs in the Egerton and Ford land systems (Payne et al., in press) where it grows in alkaline clays on calcrete slopes, shale slopes and saline drainage floors. It apparently does not extend to the higher plains of the Nooingin land system where the soils are acidic (A. A. Mitchell, pers. comm.).

Flowering and fruiting period. Flowering commences in April and is completed by mid-June. Legumes with near-mature seeds have been collected in August. As with many other arid zone species, especially those of sections Juliflorae and Plurinerves, flowering and fruiting phenology is dependent upon the incidence of rainfall.

On account of its cylindrical flower-heads and plurinerved phyllodes *A. intorta* is placed in section Juliflorae (Benth.) Maiden et Betche where it is most closely allied to *A. xiphophylla* E. Pritzel, 'Snakewood'. In addition to having similar growth habits, these two species are related by their finely multistriate phyllodes, cylindrical flower-heads with the flowers not particularly densely arranged, gamosepalous calyces, flat, narrowly oblong, firmly chartaceous legumes and their longitudinal seeds with small arils. *Acacia intorta* can be distinguished from the more widespread *A. xiphophylla* (see Maslin and Pedley 1982) by its sharply pungent, normally terete phyllodes (coarsely pungent, flat and 6-15 mm wide in *A. xiphophylla*) and its small flowers with calyces 1/4-1/2 the length of the petals (less than 1/4 in *A. xiphophylla*). Very occasionally flat phyllodes occur in *A. intorta* (see Figure 9G) but these are only 2-4 mm wide. *Acacia sibina* Maslin also has spicate inflorescences and finely multistriate, somewhat pungent, terete phyllodes but this species can be distinguished from *A. intorta* by its generally longer, more slender phyllodes, its shorter peduncles, its more numerous spikes which are normally paired within the axils of the phyllodes, its much narrower legumes (to 4 mm wide) and its smaller seeds (4 x 2.5 mm). *Acacia sibina* is a more or less rounded shrub and does not have a 'Snakewood' growth habit. A description and illustration of *A. sibina* is given in Maslin (1977). The new species has a more restricted distribution than *A. sibina;* the two taxa are not known to grow sympatrically.

The carpological material examined to date has all been slightly immature and has shown a considerable range of variation in size as indicated in the description above. On three specimens, including the type, the legumes reach 4-5 cm long and 5-6 mm wide, with seeds 4 mm long and 3 mm wide (see Figures 9D and E). However, on J. S. Beard 6113, the legumes are much larger, reaching 9 cm long and 8 mm wide with seeds 7 mm long and 5 mm wide (see Figures 9B and C). A range of mature fruiting material is required to determine whether the observed variation is continuous or not.

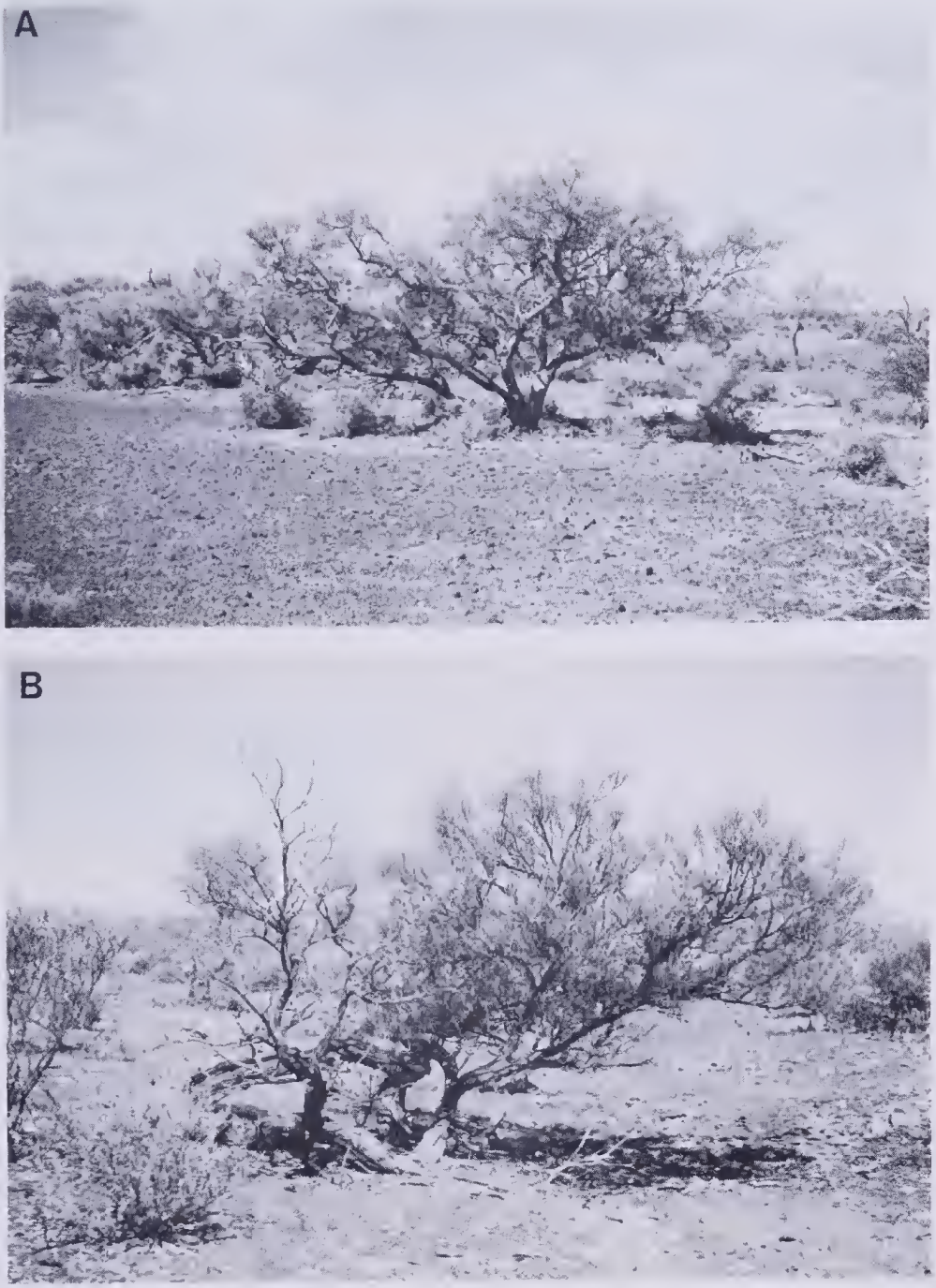

Figure 10. *Acacia intorta*. 'Snakewood' growth habit (note contorted main trunk in B spreading more or less horizontally along ground).

A—Photograph of *B. R. Maslin* 5282; B—Photographed on Tangadee Station, about 15 km NE of homestead.

The specific epithet refers to twisted, bent branches which give this species a characteristic 'Snakewood' habit.

6. **Acacia sibilans** Maslin, sp. nov. (Figures 11 and 12)

Arbor 3-5(12) m alta. *Ramuli* ad apicem incani. *Phyllodia* filiformia, c. 10-17 cm longa et 1 mm diam., laxa, incana, multistriata, ad apicem uncinata haud pungentia. *Racemi* 2-3-ramosi. *Pedunculi* 5-12 mm longi. *Capitula* globosa, 26-28-flora. *Flores* 5-meri. *Sepala* libera. *Petala* puberula. *Legumina* moniliformia ad 20 cm longa, 7-9 mm lata. *Semina* in legumine longitudinalia, ellipsoidea, 12 mm longa, 6 mm lata; *arillus* parvus.

Typus: 29 mi [46.5 km] N of The Overlander (Denham turn-off), North West Coastal Highway, Western Australia. "Tree 5 m; bark fissured, grey (habit like Myall). On loam flat." 9 September 1970, *A. S. George* 10360 (holo: PERTH; iso: CANB, K, MEL, PERTH).

Trees commonly 3-5 m tall but sometimes reaching 12 m, bushy and rounded when young but becoming more open and spreading with age, the main trunks frequently slightly twisted and ending in more or less horizontal branches, crowns dense and silvery grey-green. *Bark* grey, fibrous, longitudinally fissured except towards the ends of the branches where it is smooth. *Branchlets* terete, finely ribbed, hoary especially towards their apices (hairs minute, dense, appressed, antrorse) but becoming glabrous with age, light brown or yellow. *New shoots* densely pale citron-sericeous, the hairs soon turning white. *Stipules* deciduous. *Phyllodes* filiform, c. 10-17 cm long and 1 mm thick, terete, ascending, not rigid, straight to gently curved or very shallowly sinuous, hoary (hairs covering entire surface on young phyllodes but confined to between the nerves with age), finely longitudinally multistriate; apices uncinate, innocuous, brown; *pulvinus* 0.5-2 mm long, transversely wrinkled, orange or brown when dry; *gland* situated at distal end of the pulvinus or up to 1.5 mm above it. *Inflorescence* an extremely reduced axillary raceme of 2-3 pedunculate flower-heads, the raceme axes to 1.5 mm long and hoary. *Peduncles* 5-12 mm long, hoary, *basal peduncular bract* deciduous. *Flower-heads* globular, with 26-28 densely arranged flowers. *Bracteoles* narrowly spathulate, c. 1 mm long, claws narrowly oblong and expanded into concave, inflexed laminae which are densely pale golden puberulous abaxially. *Flowers* 5-merous. *Sepals* 2/3 the length of the petals, free, narrowly obovate; *claws* membranous, broadly linear and expanded into narrow, concave, pale golden puberulous laminae. *Petals* 2 mm long, very obscurely 1-nerved, pale golden puberulous (hairs antrorse). *Legumes* moniliform, the articles ellipsoid, to 20 cm long, 7-9 mm wide, pendulous, crustaceous to slightly coriaceous, brown, glabrescent over the seeds but hoary between them (uniformly densely hoary when very young), openly longitudinally reticulate; margins yellow, not thickened. *Seeds* longitudinally positioned within the legume, ellipsoid, 12 mm long, 6 mm wide, somewhat compressed, 3 mm thick, dark brown, not shiny; *pleurogram* obscure, elongated "u"-shaped, open towards the hilum; *areole* 6 mm long and c. 2 mm wide; *funicle* flat and linear, 5-8 mm long, reflexed below and expanded into a small pale yellow *aril.*

Other specimens examined. WESTERN AUSTRALIA: 26° parallel [North West Coastal Highway], *T. E. H. Aplin* 5213 (PERTH); 529 mi peg, North West Coastal Highway, *A. M. Ashby* 4827, per G. Phillips (BRI, MEL, PERTH); 26° parallel, North West Coastal Highway, 15 Apr. 1972, *A. M. Ashby* s.n. (PERTH); 30 mi (48 km) from turn-off along Ellavalla road, *J. S. Beard 3459 (KP, PERTH);* Beringarra Station, *J. S. Beard* 6623 (PERTH); 26th parallel, North West Coastal

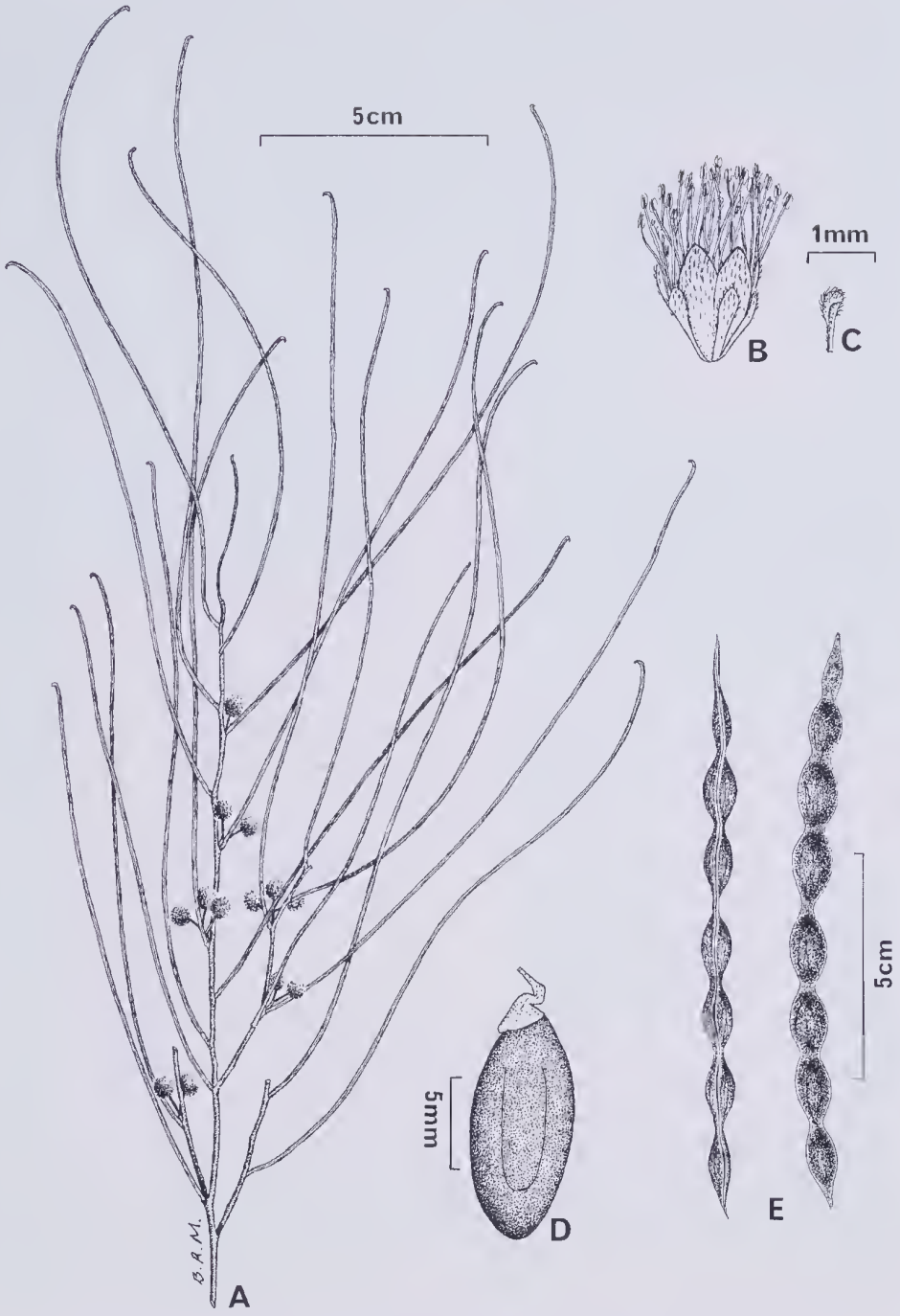

Figure 11. *Acacia sibilans*. A—Portion of branch showing filiform, uncinate phyllodes and extremely reduced axillary racemes. B—Flower showing free, antrorsely puberulous, narrowly obovate sepals and antrorsely puberulous petals. C—Bracteole. D—Seed. E—Legumes (side and plane views).
A from *G. Phillips* for *A. M. Ashby* 4827; B—C from *R. O'Farrell* 1869/17; D—E from *A. S. George* 10360 (the type).

Highway, 2 July 1982, *P. W. Hennig* s.n. (AD, CANB, MEL, NSW, PERTH); 14.5 km from Cue towards Mileura, *B. R. Maslin* 3596 (PERTH); 45 km N of Overlander [Roadhouse] towards Carnarvon, North West Coastal Highway, *B. R. Maslin* 3717 (NSW, PERTH); Carbla Station, *B. R. Maslin* 4328 (PERTH); 48.5 km N of Overlander Roadhouse, North West Coastal Highway, *B. R. Maslin* 4993 (PERTH); Moorarie Station, between Gascoyne Junction and Meekatharra, *B. R. Maslin* 5025 (PERTH); About 15 km S of Roy Hill Station on Great Northern Highway, *B. R. Maslin* 5271 (BRI, CANB, K, PERTH); Austin Downs Station near Cue, *A. A. Mitchell* 902 (BRI, MEL, NY, PERTH); Wooramel Station, *R. O'Farrell* 1869/17 (CANB, K, PERTH); 3 mi (4.8 km) N of Beringarra Station, *N. H. Speck* 992 (PERTH-dup. ex CANB).

Distribution. (Figure 14) North-west Western Australia in the Austin, Carnarvon and Fortescue Botanical Districts (1:250 000 maps F50-12; G50-5, 6, 7, 9, 10, 15). Extending from Shark Bay to near Mileura station with a single record from Roy Hill station some 500 km to the north-northeast of Mileura.

Habitat. Plains and alluvial flats in shallow light brown loam over limestone. In the region adjacent to Shark Bay on the North West Coastal Highway (from the 26° parallel north to the Wooramel River) the species is scattered but not infrequent. Here it occurs in low chenopodiaceous shrubland. Between Cue and Mileura it has been found with *A. ligulata* A. Cunn. ex Benth., *A. sclerosperma* F. Muell. and *A. victoriae* Benth. growing near 'samphire' flats.

Flowering and fruiting period. No clear pattern of flowering and fruiting phenology is detectable from the available information. Flowering specimens have been collected in both April and October. Specimens with young legumes have been collected between July and October while mature seed has been collected in April and September. Sterile specimens have been gathered in April, July, August and September.

On account of its globular flower-heads and its multistriate phyllodes the species is placed in section Plurinerves (Benth.) Maiden et Betche. *Acacia sibilans* is an attractive species with a 'Myall'-type growth habit (see Figure 12) and in this respect resembles *A. calcicola* Forde et Ising ('Northern myall'), *A. loderi* Maiden ('Nealie'), *A. papyrocarpa* Benth. ('Western myall') and some forms of *A. coriacea* DC. ('Desert oak'). These taxa show further resemblance in their common possession of globular flower-heads arranged in short axillary racemes and their finely multistriate phyllodes. Additionally, most of these species seem to be restricted to calcareous soils (see Forde and Ising 1958 and Whibley 1980). *Acacia sibilans* is distinguished by a combination of its filiform, terete phyllodes, its large, moniliform, crustaceous to slightly coriaceous legumes and its large seeds with small, pale yellow arils. With the exception of the widespread arid zone species *A. coriacea, A. sibilans* occurs further west than the other species listed above (Maslin and Pedley 1982). Aspects of speciation in arid zone Acacias, including *A. sibilans,* are discussed in Maslin and Hopper (1982)—the new species being there referred to as *Acacia* sp. no. 3 in Figure 6c.

The specific epithet refers to the characteristic hissing noise made by wind blowing through the canopy. This noise is frequently heard on species with delicate foliage; it is especially characteristic of She-oaks (*Allocasuarina* species).

Figure 12. *Acacia sibilans*. Photograph of *B. R. Maslin* 4993.

7. **Acacia ancistrocarpa** x **A. trachycarpa** (Figure 13)

More or less obconic *shrubs* to 3 m tall with a rather spreading and untidy aspect, single-stemmed or sparingly branched at ground level. *Bark* grey, exfoliating in a 'Minni Ritchi' fashion (i.e. shedding in narrow strips which curl retrorsely from each end) at extreme base of main trunk revealing a reddish brown underlayer, soon becoming smooth. *Branchlets* terete, finely ribbed, glabrous, greenish or yellow-brown to red-brown. *Stipules* triangular to deltate, 0.5-1 mm long, scarious but thickened at the base, dark brown. *Phyllodes* broad-linear to very narrow elliptic, 9-12 cm long, 4-7 mm wide, length to width ratio 13-26, normally slightly curved, ascending to somewhat spreading, not rigid, upper margin slightly thickened, somewhat shiny (at least when young), glabrous, medium pure green, narrowed at the *apex* into acute, coarsely pungent, callose points which are 1-2 mm long and straight or slightly recurved; *pulvinus* c. 2 mm long, orange; *nerves* numerous and parallel, sometimes sparingly anastomosing, interstices distinct (0.2-0.3 mm wide), the central nerve as well as one on either side of it more evident than the rest, slightly raised when dry; *gland* situated on the upper margin of the phyllode 1-3 mm above the pulvinus, elliptic, c. 0.5 mm long, lip only slightly raised and surrounding a slit-like orifice. *Inflorescence* (1)2(3) per node, arising within axils of phyllodes, or alternatively, near the base of axillary new shoots in which cases they are not subtended by phyllodes. *Peduncles* 6-12 mm long, glabrous; *basal peduncular bracts* absent at anthesis. *Receptacles* glabrous. *Spikes* 20-25 mm long and 3-4 mm wide (when dry), flowers densely arranged. *Bracteoles* spathulate, c. 0.7 mm long, sparsely puberulous, claws linear and expanded into narrowly ovate, inflexed, shallowly concave, non-thickened, acute laminae. *Flowers* 5-merous. *Calyx* about 1/2 the length of the corolla, shortly white-villous, divided for about 1/2-3/4 its length into broadly linear lobes. *Corolla* 1-1.5 mm long, glabrous, 1-nerved. *Legumes* and *seeds* not seen.

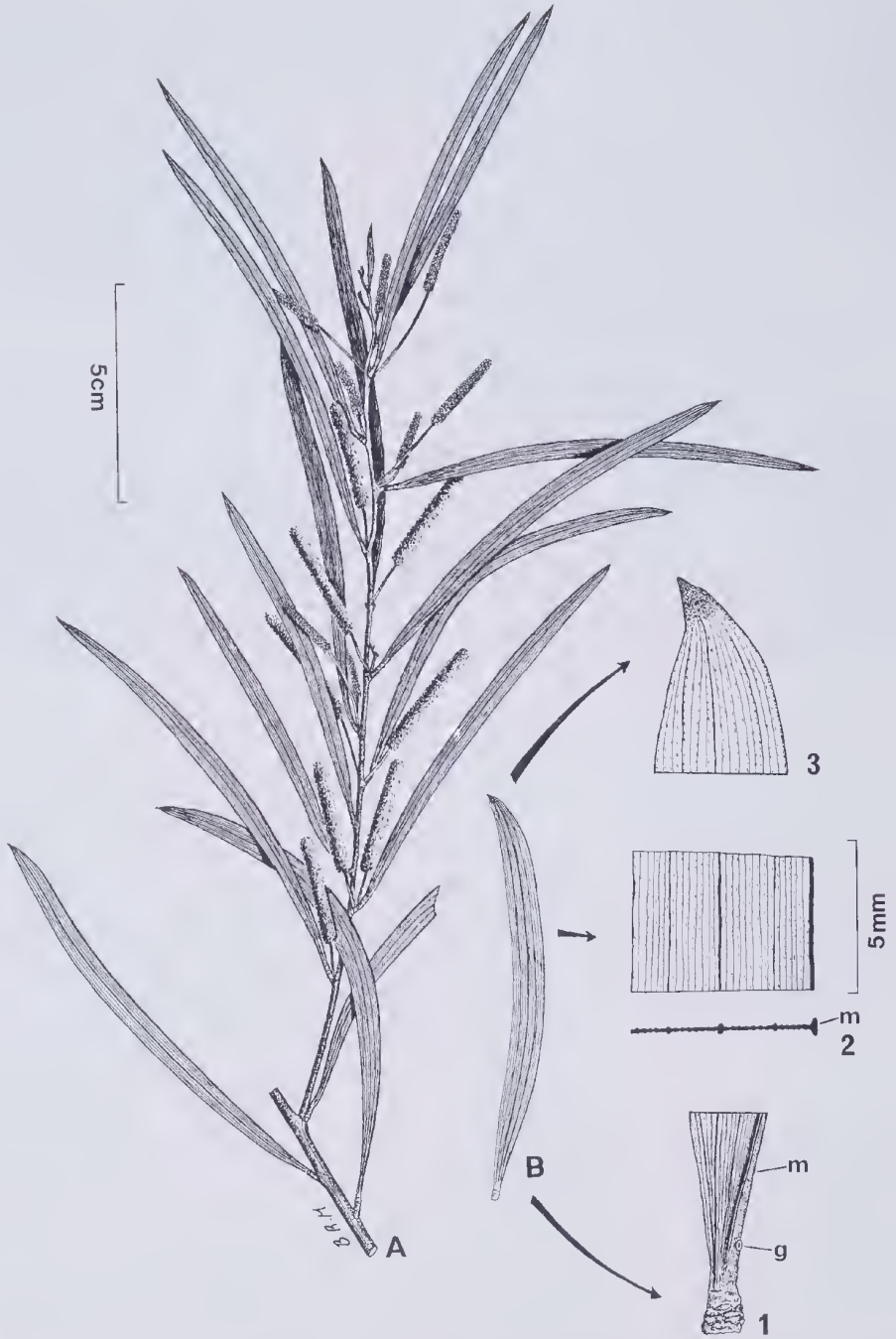

Figure 13. *Acacia ancistrocarpa* x *A. trachycarpa*. A—Portion of branch showing spicate inflorescences. B—Phyllode with enlargements showing (1) base of phyllode with gland (g) situated on surface of thickened upper margin (m), (2) middle of phyllode with silhouette showing nerves (note thickened upper margin m), and (3) apex of phyllode with a coarsely pungent mucro.

All from *N. T. Burbidge* 1134.

Other specimens examined. WESTERN AUSTRALIA: Nullagine road south of Mount Edgar Station, *N. T. Burbidge* 1134 (BRI, PERTH); 3 mi (4.5 km) S of Roebourne towards Cooya Pooya, *B. R. Maslin* 2743 and 5252 (both PERTH); 6 mi (10 km) N of Fortescue River crossing on North West Coastal Highway, *B. R. Maslin* 2758 (CANB, K, PERTH).

Distribution. (Figure 14) North-west Western Australia in the Fortescue Botanical District (1:250,000 maps F50-3,6; F51-5). Known only from three localities in the Pilbara area (see above).

Habitat. Seemingly restricted to rocky watercourses.

Flowering period. Flowering specimens have been gathered in June, however, because of the lack of collections, it is not possible to assess the range of flowering phenology.

Judging from field observations and from morphological criteria this taxon appears to be a hybrid between the Juliflorae species *Acacia ancistrocarpa* Maiden et Blakely and *A. trachycarpa* E. Pritzel. It is known only from three scattered localities in the Pilbara region and at one of these visited recently by the author the two putative parents were common together with a few plants of the possible hybrid (see Maslin 5252). No apparent back-crossing was observed at this locality. *Acacia trachycarpa* is a 'Minni Richi' species with red bark that exfoliates in narrow shavings that curl retrorsely from each end, it has persistent stipules and non-shiny, very narrow phyllodes (1-2 mm wide) which possess the unusual character for an *Acacia* of having a thickened upper margin. *Acacia ancistrocarpa* on the other hand has grey, non-'Minni Ritchi' bark, its stipules are deciduous and its phyllodes range from 2-11 mm in width and lack thickened upper margins. As can be seen from the description above this presumed hybrid has grey bark which, at the extreme base of the trunks, exfoliates in a 'Minni Ritchi' fashion, it has persistent stipules, and has phyllodes which are wide but possess a thickened upper margin. It is these morphological features, together with the fact that the taxon is of scattered occurrence and grows (at least at one locality) in association with *A. ancistrocarpa* and *A. trachycarpa* that suggest a hybrid origin. It is not known whether this presumed hybrid sets fruit; if it does, these will be useful in clarifying the status of the taxon. *Acacia trachycarpa* is mainly confined to the Pilbara region where it is common along creeks and rivers. *Acacia ancistrocarpa* is also common in the Pilbara but extends eastward through the arid zone to the Northern Territory and Queensland (Maslin and Pedley 1982). If further examples of this hybrid are to be located then they may be expected along watercourses.

Acknowledgements

Andrew Mitchell, Alan Payne, John Stretch and Peter Hennig (W.A. Department of Agriculture) are thanked for making special field collections for some included taxa. I would also like to thank Professor K. H. Rechinger for checking the Latin descriptions and Suzanne Curry for her very competent field and technical assistance. The project was conducted at the Western Australian Herbarium (PERTH) with financial assistance provided under an Australian Biological Resources Study grant from the Bureau of Flora and Fauna.

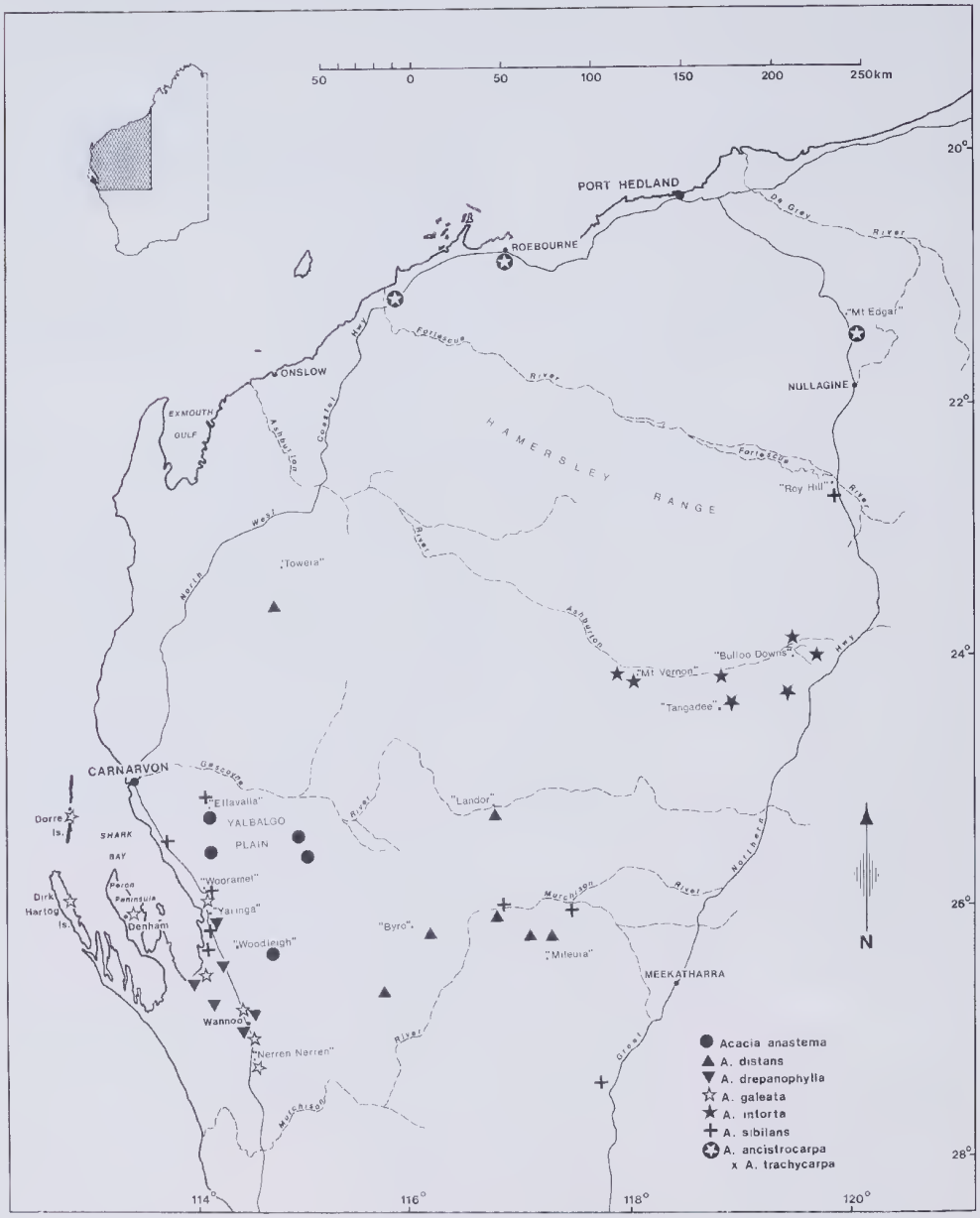

Figure 14. Map showing distribution of *Acacia anastema, A. distans, A. drepanophylla, A. galeata, A. intorta, A. sibilans* and *A. ancistrocarpa* x *A. trachycarpa*.

Index to specimens studied

This index is arranged alphabetically according to the name of the collector. Numbers in parentheses refer to the corresponding numbered species in the text. Unless otherwise indicated the specimens cited are housed at the Western Australian Herbarium (PERTH). Abbreviations for herbaria are those given in Index Herbariorum Part 1 Edition 7 (1981). In the case of Kings Park and Botanic Garden, Perth, there is no formal abbreviation so KP is used informally here.

Aplin, T.E.H. 5213(6)

Ashby, A.M. 3833(3), 4582(3), 4610(1-AD, CBG, PERTH), 4739(4-AD, PERTH), 4827(6-BRI, MEL, PERTH) 5334(3), s.n. 15 April 1972 (6)

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Blackall, W. E. 4702(3)

Brockway, G. E. 1(2)

Burbidge, N. T. 1134(7-BRI, PERTH)

Cranfield, R. J. 1749a(2-MEL, PERTH)

Demarz, H. D. 3329(1-KP, PERTH), 5184(1-KP, PERTH)

Evans, T. s.n. April 1974 (4)

George, A. S. 10360 (6-Type: CANB, K, MEL, PERTH), 11510 (4)

Glauert, L. s.n. May 1922 (2)

Hennig, P.W. s.n. (4-Type: CANB, K, MEL, NY, PERTH), s.n. (3-K, MEL, NSW, PERTH), s.n. (6-AD, CANB, MEL, NSW, PERTH)

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Kenneally, K. F. 1335(4), 4652(4)

Kruiskamp, J. 4096(2), 4100(2)

Maslin, B. R. 2631(3), 2743(7), 2758(7-CANB, K, PERTH), 2772(4-BRI, CBG, MEL, NSW, NY, PERTH) 2778(3-Type: AD, B, BRI, MO, PERTH, RSA; distributed as *A. oldfieldii*), 2781(4-CANB, K, PERTH) 3596(6), 3655(3), 3656(3), 3657(4), 3717(6-NSW, PERTH) 4320(3), 4321(3), 4328(6), 4987(3), 4989(4), 4992(3-CANB, PERTH), 4993(6), 5004(1-Type: BM, BRI, CANB, G, K, MEL, NSW, NY, PERTH) 5004a(1), 5025(6), 5161(4), 5163(1), 5174(2-BRI, MEL, PERTH), 5183(2-Type: BRI, CANB, K, MEL, NSW, NY, PERTH), 5252(7), 5271(6-BRI, CANB, K, PERTH), 5282(5-BRI, PERTH), 5286(5-CANB, PERTH).

Milne s.n. (4-K)

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O'Farrell, R. 1869/17(6-CANB, K, PERTH)

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Stretch, J. s.n. 23 Nov. 1981 (4)

Wareham, J. s.n. June 1957 (4)

Weston, A. S. 6891(3-CANB, PERTH), 10604(4-PERTH, TLF)

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A morphometric and anatomical study of the *Darwinia diosmoides* complex (Myrtaceae) in south-western Australia

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Abstract

Rye, B. L. A morphometric and anatomical study of the *Darwinia diosmoides* complex (Myrtaceae) in south-western Australia. Nuytsia 4 (3): 411-421 (1983). Both floral morphology and leaf anatomy proved to be of little value in distinguishing the three variants of the *Darwinia diosmoides* complex. Morphometric analysis of foliar characters confirmed that the northern variant, which differs in chromosome number and several other respects, should be recognized as a new species (*D. capitellata* Rye). However, the two southern variants showed complete intergradation in their foliar characters; hence they were not considered sufficiently distinct to be given formal taxonomic rank.

Introduction

The variants and close relatives of *Darwinia diosmoides* (DC.) Benth., which will be referred to collectively as the *D. diosmoides* complex, are distributed over a wide area in the southwest of Western Australia. The first name to have been applied to members of the complex was *Genetyllis diosmoides* DC., which Bentham (1865) transferred to *Darwinia*. Turczaninow (1847) described two short-leaved variants as *Genetyllis affinis* and *G. drummondii* (misspelt *drumondii*) respectively, claiming that the former had a smooth calyx tube. However, Bentham (1865, 1867), who had rightly noted that the calyx tube of *G. affinis* had protuberances similar to those of *Darwinia diosmoides*, reduced both this and *G. drummondii* to synonyms of *D. diosmoides*.

All variants of the *Darwinia diosmoides* complex are bushy shrubs, up to one metre high, bearing numerous head-like condensed racemes of tiny white flowers during the spring and summer months. Three main morphological variants may be recognized in the complex, occupying distinct habitats and geographical areas. However, the first two appear to show considerable intergradation, particularly in the east of their ranges. Figure 1 illustrates the distributions of these variants, which are characterized as follows:

(1) South-coastal, associated with cliffs and rock outcrops, n=7, 14. Includes the type specimen of *Darwinia diosmoides*.
(2) Central, associated with salt lakes, n = 14. Includes the type specimen of *Genetyllis affinis* and probably *G. drummondii*.
(3) Northern, on sandplain areas and breakaways, n = 12. Now described as *Darwinia capitellata* Rye (Rye 1983).

The *Darwinia diosmoides* complex was chosen for a special study because it had been found earlier (Rye 1979) to show both dysploid and polyploid variation in chromosome number, having n = 7, 12 and 14 as indicated above. Smith-White (1954) reported a further chromosome number, n = 6, from material collected at Albany but there is no voucher specimen for the record. Presumably, the n = 6 record was made from a different species because two Albany populations sampled by Rye (1979) each had n = 14.

Figure 1. Distribution of the *Darwinia diosmoides* complex.

△, A-D: populations of the northern variant (*Darwinia capitellata*); ▽, E-X: central and south-coastal populations (*D. diosmoides*). Dotted lines indicate the overall ranges of the two species.

Aside from its unique chromosome number (n = 12), habitat and geographical distribution, the northern variant (*Darwinia capitellata*) can be distinguished from the remainder of the complex by its vegetative characteristics, inflorescence structure and distribution of oil glands. However, it does not show any obvious differences in floral morphology from the other variants. Populations of the central variant tend to have tiny appressed leaves, whereas the south-coastal variant tends to have longer, more spreading leaves, but again there are no obvious differences in floral morphology. It was not certain whether there was sufficient discontinuity between the central and south-coastal variants, especially in the eastern part of their ranges, to warrant their formal recognition as distinct taxa.

The aim of this study was to investigate the taxonomy of the three variants by means of morphometric analyses and examination of leaf anatomy, in particular to determine whether:

(1) the northern variant could be distinguished from the remainder of the complex by its floral morphology.
(2) the two southern variants were sufficiently distinct to be given formal taxonomic rank.

Materials and Methods

Canonical Variate Analysis

Morphometric data were collected in a form appropriate for the application of the canonical variate analysis employed in Phillips et al. (1973), which should be consulted for details of the mathematical basis of this technique. The analysis is de-

signed to give the greatest possible separation of a number of groups, comprising numerous representatives, each measured for a number of variables. In this case the groups were plant populations, represented by numerous plant individuals, and the variables measured were the 9 floral and 6 foliar characters illustrated in Figure 2. Maximum separation can be achieved by a multidimensional representation of the groups but the first two axes account for the bulk of the separation. These two dimensions can be readily illustrated in the form of a scatter diagram. For each axis the individuals of each group are assigned a 'canonical variate score' which consists of a combination of all the measured variables, each given a different weighting according to its usefulness in achieving the separation. A quantitative measure of the overall degree of separation achieved by the analysis can be obtained by calculating the 'canonical root', which is higher in value the greater the separation.

The validity of the canonical variate scores for distinguishing the groups can be tested by sampling extra individuals, referred to here as 'testers', including some from the populations that constitute the groups. If the separation is soundly based, the canonical scores of the testers should place them close to other members of their groups so that they can be readily identified.

Table 1. Details of populations sampled for the canonical variate analyses of the *Darwinia diosmoides* complex.

Population			No. of individuals	
*Symbol	Locality	Voucher	Group typifiers	Testers
Northern variant *(D. capitellata)*				
A	Paynes Find	B. L. Powell 73012	20	5
B	Perenjori (H)	C. A. Gardner s.n.	—	1
C	Mount Magnet (H)	B. L. Powell 74045	—	1
D	Coolcalalaya (H)	J. S. Beard 7148	—	1
Central variant				
E	Damboring	B. L. Rye 77025	20	5
F	Quairading	B. L. Powell 74126	25	6
G	Cultivated, ex Cunderdin	—	—	2
H	Cultivated Kings Park	—	—	1
I	Pingaring	B. L. Rye 77023	—	1
J	Lake King (H)	A. S. George s.n.	—	1
K	One Mile Rocks (H)	A. S. George 10471	—	1
Intermediate between central and south coastal variants				
L	Stirling Range	—	—	1
M	Hamersley River (H)	A. S. George 7091	—	1
N	Twilight Cove (H)	E. C. Nelson 17172	—	1
O	Cape Arid (H)	R. D. Royce 9886	—	1
P	Dalyup-Esperance (H)	T. E. H. Aplin 2646	—	1
Q	Bedford Harbour (H)	J. S. Beard 2270	—	1
R	Mount Short (H)	E. Wittwer 1883	—	1
South-coastal variant				
S	Duke of Orleans Bay (H)	R. D. Royce 6234	—	1
T	East Mt Barren (H)	C. A. Gardner & W. E. Blackall	—	1
U	Mid Mt Barren (H)	C. A. Gardner 9221	—	1
V	Cultivated, ex Pt Ann	—	—	2
W	Two Peoples Bay	B. L. Powell 74130	30	6
X	Albany	B. L. Powell 74131	10	4

* Reference letter for Figures 1, 3 and 4.
(H) Sampled from herbarium specimen in PERTH.

In this study two separate analyses were undertaken, using floral and foliar characters respectively. Details of the populations sampled are given in Table 1. Five populations were selected as the groups for the initial separation and about five individuals from each were reserved for use as testers. Six additional plants, most of them cultivated in Perth, were used as testers for both the floral and foliar analyses. In order to provide testers from throughout the range of the *Darwinia diosmoides* complex, portions of fifteen herbarium specimens were given a prolonged soaking in a detergent solution. These specimens were used only for the foliar analysis. The five main populations included one population of the northern variant of the complex, two typical of the central variant and two typical of the south-coastal variant, while the tester populations encompassed the three variants and also a number of populations that appeared to be intermediate in morphology between the typical central and south-coastal variants.

Anatomy

Leaves collected from the following populations were embedded in wax or GMA resin, cut into 2μm or 6μm sections respectively, then stained in toluidine blue or saffranin/fast green:

Northern variant—Paynes Find (location A in Figure 1)

Central variant—Damboring (E)
—Cultivated ex Cunderdin (G)
—Cultivated in Kings Park (H)

South-coastal variant—Cultivated ex Pt Ann (V)

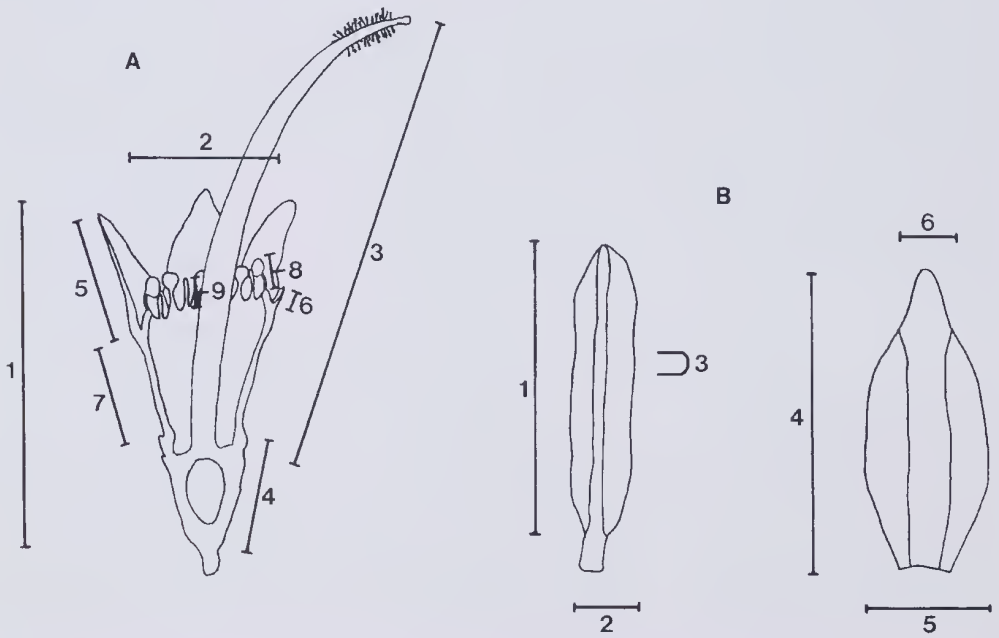

Figure 2. Characters measured for the canonical variate analyses of the *Darwinia diosmoides* complex.

A. Floral characters: 1 — Flower length. 2 — Flower width. 3 — Style length. 4 — Ovary length. 5 — Petal length. 6 — Sepal length. 7 — Floral tube length. 8 — Stamen length. 9 — Staminode length.

B. Foliar characters: 1 — Leaf length. 2 — Leaf width. 3 — Leaf thickness. 4 — Bracteole length. 5 — Bracteole width. 6 — Bracteole midrib width.

Table 2. Mean measurements for populations used in the canonical variate analyses of the *Darwinia diosmoides* complex.

Characters measured	Population means (mm)				
	Paynes Find	Damboring	Quairading	Two Peoples Bay	Albany
Floral analysis					
Flower length	4.27 (±0.07)	4.26 (±0.06)	4.26 (±0.06)	3.85 (±0.05)	4.26 (±0.09)
Flower width	1.82 (±0.02)	1.75 (±0.03)	1.82 (±0.03)	1.67 (±0.03)	1.82 (±0.04)
Style length	6.01 (±0.10)	5.47 (±0.08)	4.60 (±0.07)	4.89 (±0.07)	5.10 (±0.11)
Ovary length	1.54 (±0.03)	1.78 (±0.04)	1.63 (±0.04)	1.43 (±0.03)	1.65 (±0.06)
Petal length	2.10 (±0.04)	1.99 (±0.03)	1.84 (±0.04)	1.54 (±0.03)	1.64 (±0.04)
Sepal length	0.61 (±0.02)	0.46 (±0.02)	0.39 (±0.02)	0.34 (±0.01)	0.27 (±0.01)
Upper floral tube length	0.98 (±0.02)	0.99 (±0.02)	0.79 (±0.02)	0.87 (±0.02)	0.89 (±0.02)
Stamen length	0.75 (±0.02)	0.65 (±0.01)	0.50 (±0.01)	0.41 (±0.01)	0.50 (±0.01)
Staminode length	0.35 (±0.01)	0.39 (±0.01)	0.38 (±0.01)	0.40 (±0.01)	0.38 (±0.02)
Foliar analysis					
Leaf length	4.23 (±0.16)	1.96 (±0.06)	2.63 (±0.05)	3.88 (±0.10)	4.29 (±0.23)
Leaf width	1.02 (±0.02)	1.08 (±0.03)	1.04 (±0.04)	0.53 (±0.01)	0.63 (±0.03)
Leaf thickness	0.66 (±0.01)	0.71 (±0.02)	0.60 (±0.02)	0.48 (±0.01)	0.56 (±0.02)
Bracteole length	2.33 (±0.07)	2.49 (±0.06)	3.03 (±0.06)	2.65 (±0.05)	3.10 (±0.09)
Bracteole width	1.47 (±0.05)	1.01 (±0.02)	1.00 (±0.03)	1.00 (±0.02)	1.05 (±0.03)
Bracteole midrib width	0.14 (±0.01)	0.50 (±0.02)	0.54 (±0.03)	0.68 (±0.02)	0.72 (±0.03)

Results

Morphometrics

Table 2 lists the group means for each of the characters measured in the floral and foliar canonical analyses. The character weightings (standardized character coefficients) and canonical roots for the first two canonical variates are given in Table 3 and scatter diagrams showing the positions of all group and tester individuals with respect to the first two canonical axes are given in Figures 3 and 4.

In the analysis based on foliar characters, the bracteole midrib width and bracteole total width (these were negatively correlated) contributed most to the first canonical variate, which accounted for 57% of the total group separation. Leaf length and

Table 3. Character weightings and canonical roots obtained in the canonical analyses of the *Darwinia diosmoides* complex.

Character weightings and measures of separation	Canonical variate 1	Canonical variate 2
Floral analysis		
Character coefficients (standardized)		
Flower length	—0.228	0.332
Flower width	—0.071	0.288
Style length	0.325	—0.476
Ovary length	0.008	0.371
Petal length	0.460	0.407
Sepal length	0.218	—0.201
Floral tube length	0.224	—0.553
Stamen length	0.778	0.149
Staminode length	—0.437	—0.474
Canonical root	7.18	1.32
% Total separation	77.1	14.2
Foliar analysis		
Character coefficients (standardized)		
Leaf length	—0.155	0.970
Leaf width	0.350	—0.568
Leaf thickness	0.201	—0.068
Bracteole length	—0.097	—0.829
Bracteole width	0.757	0.465
Bracteole midrib width	—1.000	0.014
Canonical root	13.01	9.15
% Total separation	56.8	39.9

bracteole length were positively correlated and contributed most to the second canonical variate, which accounted for a further 40% of the total separation. Thus only 3% of the total group separation was not represented in Figure 3. The canonical roots were relatively high (13 and 9) and the 5 groups (populations) separated into 3 very distinct entities corresponding with the 3 variants of the *Darwinia diosmoides* complex. Testers from the same five populations invariably could be identified according to their variant of the complex, although not necessarily to their particular population; this demonstrated that the separation of the groups into three entities was valid.

The other testers in the foliar analysis showed a greater deviation from the various group means. Testers derived from populations of the northern variant *Darwinia capitellata* could all be readily identified as this variant, supporting its recognition as a distinct taxon. However, many of the testers derived from populations of the central and south-coastal variants fell into the region separating the groups that represented these two variants. When all these populations were considered jointly there was no obvious region of discontinuity which could permit the central and south-coastal populations to be separated into distinct taxa.

In the analysis of floral characters, very little separation of the groups was achieved as can be seen from Figure 4 and the low values of the canonical roots (7 and 1). The three floral characters contributing most to the separation (77% of the total separation) achieved by the first canonical variate were stamen length, petal length and staminode length. There was a north-south trend in each of these charac-

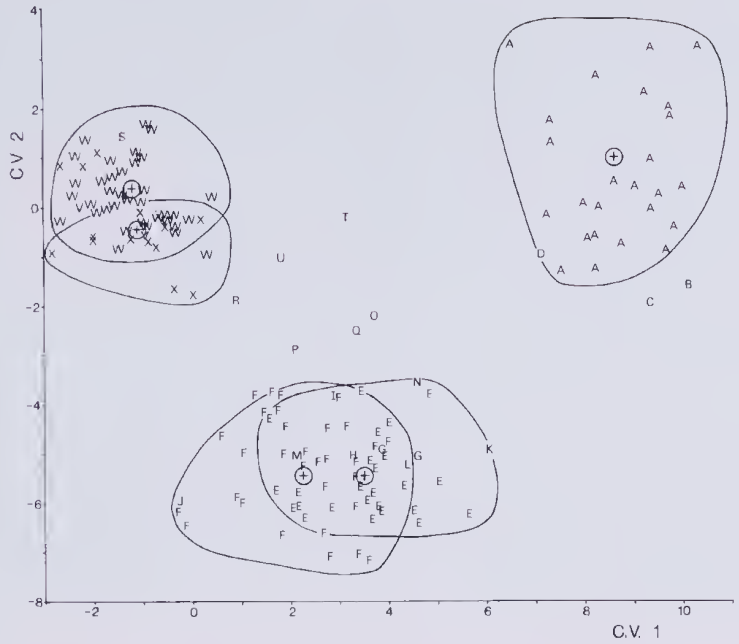

Figure 3. Separation achieved by the first two canonical variates in the analysis of foliar characters of the *Darwinia diosmoides* complex.

A-X: the populations represented by these letters are indicated in Table 1. Lines enclose the members of each group (A, E, F, X and W) but not necessarily the testers of those groups. C.V. — canonical variate; ⊕—population mean.

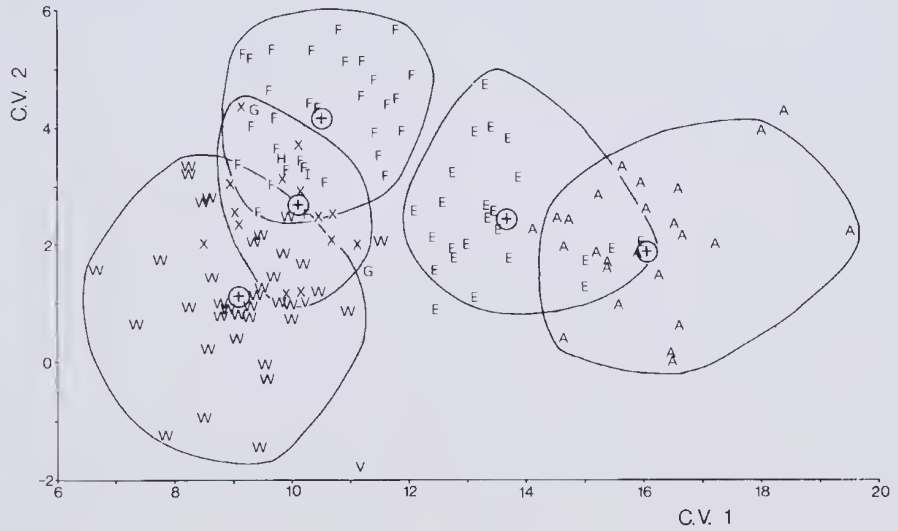

Figure 4. Separation achieved by the first two canonical variates in the analysis of floral characters of the *Darwinia diosmoides* complex.

A-X: the populations represented by these letters are indicated in Table 1. Lines enclose the members of each group (A, E, F, X and W) but not necessarily the testers of these groups. C.V.—canonical variate; ⊕—population mean.

ters, the northern populations tending to have the longer stamens, longer petals and shorter staminodia. The difference between the lengths of the stamens and staminodia provided the most useful floral characteristic for distinguishing different populations. In young flowers of the most northerly populations, the staminodia appeared distinctly shorter than the stamens whereas they appeared equally long in the southernmost populations. However, all the floral characters exhibited continuous variation and tester individuals could not be reliably identified by their canonical variate scores. Consequently the floral analysis provided evidence for the retention of all variants of the *Darwinia diosmoides* complex as a single species.

In summary, the northern variant (*Darwinia capitellata*) could be identified by its foliar characters, chiefly its large midrib width/bracteole width ratio, but not by its floral characters. The two southern variants (*D. diosmoides*) could not be reliably distinguished from one another either by foliar or floral characters.

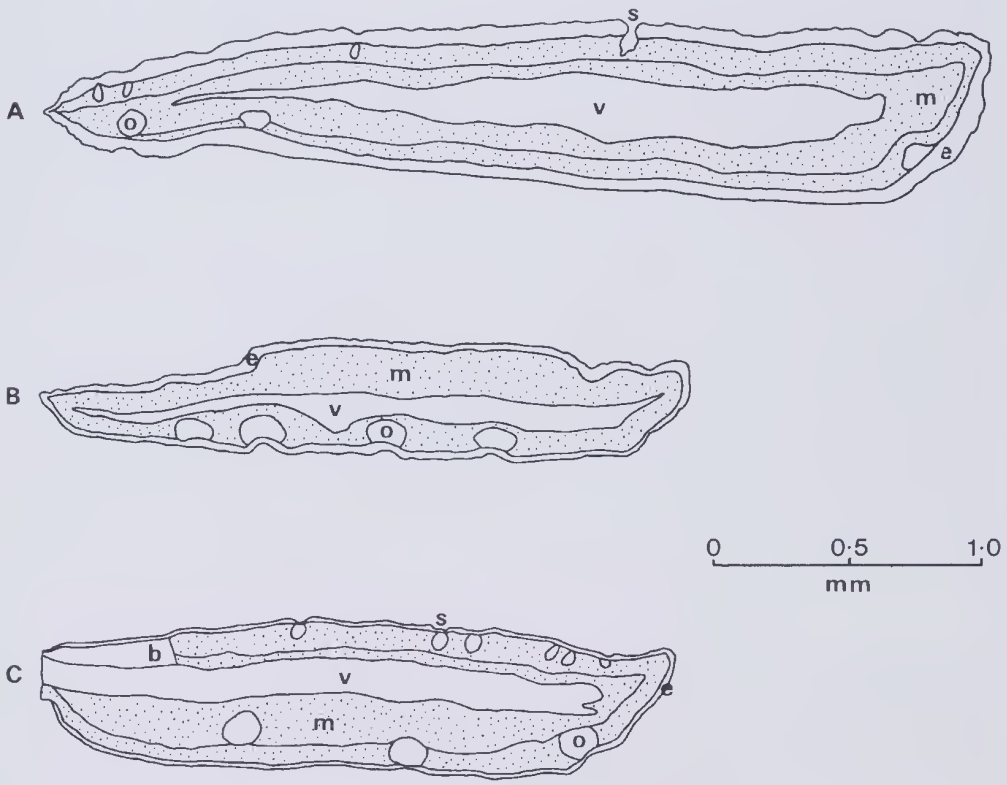

Figure 5. Leaf anatomy in the *Darwinia diosmoides* complex. (Longitudinal sections with the adaxial surface uppermost, the apex to the right.)

A—Northern variant (*Darwinia capitellata*) from Paynes Find. B — Central variant from Damboring. C — Cultivated at Kings Park.

b — bulliform cells (subepidermal); e — epidermis and cuticle; m — mesophyll (dotted), the outer layer palisade parenchyma, the inner layer spongy parenchyma; o — oil glands and associated cells; s — stomata and stomatal cavities; v — vascular tissue of the midrib and associated fibres.

Anatomy

The leaves of the northern variant had thicker cuticles than those of the two southern variants but showed no other notable anatomical differences (see Figure 5). The only qualitative difference in leaf anatomy found between the populations sampled was the presence/absence of large thin-walled cells (apparently bulliform cells) in a subepidermal adaxial region above the midrib (illustrated in Figure 5c). These cells were present only in a cultivated plant (n = 14) of unknown origin, which appeared to have been derived from a population of the central variant. This characteristic did not assist in distinguishing the variants in the *Darwinia diosmoides* complex because it was not present in two other populations of the central variant.

Discussion

The canonical variate analysis provides an objective means of assessing the relative values of various quantitative characters for taxonomic divisions. While its main function is to maximize the separation of predetermined groups and to indicate which characters are most useful in achieving this separation, it also serves to indicate which groups should be combined on the basis of the characters measured.

In the present example, the analyses demonstrated that the five *Darwinia* groups showed continuous variation in their floral characters. They also showed that two pairs of groups could not be distinguished by their foliar characters. The groups belonging to each of these pairs were populations of the same variant of the *Darwinia diosmoides* complex. If they had been combined so that each variant was represented by only one group (i.e. three groups used for the analysis instead of five), the analysis could have given these entities greater cohesion and separated them more successfully from one another. The locations of the tester populations in Figure 3 confirmed the distinctiveness of the northern variant but demonstrated that the two southern variants of the *D. diosmoides* complex could not be adequately distinguished.

The use of herbarium specimens for many of the testers probably introduced a small error into the measurements because the effects of dehydration and pressing on the size and shape of the leaves may not have been completely rectified by rehydration. A more significant source of variability in the measurements was environmental. Considerable seasonal and yearly variation in leaf size was observed in natural populations. By increasing the intra-populational variability, this effect would have tended to obscure the differences between populations since the plants used in this study, particularly the herbarium specimens, were sampled in varied season over many years.

If the observed morphological differences between populations occupying different habitats were largely due to environmental effects rather than genetic factors, they would not be valid criteria for taxonomic divisions. However, specimens from widely separated natural populations maintained large morphological differences when grown under uniform conditions in Perth gardens. Several cultivated plants of known origin were tested in the foliar analysis and all were correctly identified to their variant of the *Darwinia diosmoides* complex.

Floral characters showed less intra-populational variability than foliar characters (see Table 3) and also appeared to show less variability from year to year. They would, therefore, have been more suitable criteria than the foliar characters for taxonomic divisions if they had shown more significant differences between populations.

The anatomical differences between the three variants of the *Darwinia diosmoides* complex have only been examined briefly in the present study. The observed variation in cuticle thickness was correlated with, and presumably a function of, the aridity of the habitat from which the leaf samples were taken. The thinnest cuticles occurred in the well watered cultivated plants. In view of the observed differences in leaf anatomy between populations of the central variant, it is evident that many more populations would need to be surveyed before any firm conclusions could be reached regarding the taxonomic value of anatomical critera. Possibly studies of flower or stem anatomy would prove more valuable than leaf anatomy for distinguishing the taxa.

It is concluded that the two southern variants are not sufficiently distinct in any of the characters examined here to be formally recognized as intraspecific taxa of *Darwinia diosmoides*. The northern variant shows no significant difference in either its floral morphology or leaf anatomy from the two southern variants but differs in its foliar characters and in several other morphological characters. Details of the latter characters are given in the accompanying paper (Rye 1983), in which the northern variant is described as the new species, *D. capitellata* Rye.

The *Darwinia diosmoides* complex (with n = 7, 12, 14) and its close relatives, *D. vestita* (n = 9) and *Actinodium cunninghamii* (n = 6), are notable among the Myrtaceae for their variety of chromosome numbers. The ancestral chromosome number among these taxa is evidently n = 9, dysploid reduction having given rise to the n = 7 and n = 6 cytotypes (Smith-White 1959, Rye 1979). This suggests that *D. capitellata* is derived from *D. diosmoides* or a *diosmoides*-like ancestor, not vice versa. The tetraploid n = 12 cytotype may have been derived either by a reduction at the tetraploid level (14 → 12) or by polyploidy from a hypothetical n = 6 ancestor, which in turn had been derived by dysploid reduction from n = 7 (7 → 6⇒ 12).

Although the exact origin of the new chromosome number in *Darwinia capitellata* is not known, the establishment of the new number may have been instrumental in achieving sufficient reproductive isolation to permit the morphological divergence of the species from *D. diosmoides*. The two species are allopatric, precluding natural hybridization. It would be worthwhile conducting artifical hybridization studies on cultivated plants to determine the degree and nature of reproductive isolation when the spatial barrier is removed.

Acknowledgements

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Darwinia capitellata (Myrtaceae), a new species from south-western Australia

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Abstract

Rye, B. L. *Darwinia capitellata* (Myrtaceae), a new species from south-western Australia. Nuytsia 4(3): 423-426 (1983). A new species, *Darwinia capitellata* Rye, is described. It differs from its closest relative, *D. diosmoides* (DC.) Benth., in bracteole shape and texture, distribution of oil glands, arrangement of flower heads, chromosome number and geographical distribution.

Introduction

This paper provides a formal taxonomic description of *Darwinia capitellata*, whose closest relative is *D. diosmoides*. The existence of the new species was first noticed when its chromosome number (n = 12) was found to differ from those of *D. diosmoides* (n = 7, 14). The chromosome numbers of both species were reported in Rye (1979), where *D. capitellata* was referred to as '*D.* sp. aff. *diosmoides*'. A morphometric and anatomical study of the two species (Rye 1983) showed that they could be distinguished by their foliar morphology, in particular the bracteoles, but not by their floral morphology or leaf anatomy. In the latter paper *D. capitellata* was referred to as the 'northern variant' of the *D. diosmoides* complex. That paper should be consulted for details of the scientific names that have been applied to the species complex, illustrations of the geographical distributions of the species and a discussion of the origin of their chromosome numbers.

Like many other members of the genus, *D. capitellata* and *D. diosmoides* produce head-like condensed racemes. For simplicity, these inflorescences are referred to here as 'heads'. Using the terminology of Briggs and Johnson (1979), the heads are capitulum-like racemiform conflorescences made up of uniflorescences. The uniflorescences are pedunculate monads (referred to here as pedicellate flowers) with 2 prophylls (bracteoles) and no anthopodium (meaning that the flowers are sessile within the bracteoles).

Measurements for the description of *D. capitellata* were obtained from all the Western Australian Herbarium (PERTH) herbarium specimens (cited at the end of the description) and from fresh material collected at Paynes Find. No specimens from other herbaria were examined.

New species description

Darwinia capitellata Rye, sp. nov. (Figure 1)

D. diosmoidi (DC.) Benth. affinis a qua habitu multiramoso, caule glandulis oleiferis prominentibus ornato, bracteolis multo magis scariosis, capitulis florum laxe corymboideis, chromosomatum numero differt.

Figure 1: Holotype of *Darwinia capitellata* Rye.

Typus. Near Paynes Find, Western Australia, November 1951, *C. A. Gardner* 11999 (holo: PERTH; iso: K, CANB, NSW, MEL).

Related to *Darwinia diosmoides* (DC.) Benth. but differs in the more branched habit, prominent oil glands on the youngest stems, more scarious bracteoles, corymb-like arrangement of the flower-heads and chromosome number.

Bushy much-branched *shrub* to 1 m high. *Youngest stems* pale, with prominent oil glands. *Leaves* aggregated towards the stem apices, shortly petiolate on prominent leaf bases, widely spreading to appressed; *laminae* triquetrous to plano-convex, 2.5-4.5 x 0.5-1 mm, dotted with prominent oil glands. *Flowers* in head-like condensed racemes, which are associated into a corymb-like arrangement, the terminal head of the corymb typically with more flowers than the lower heads, which are usually 4-8-flowered. *Pedicels* 0.5-1 mm long, prominently 5-ribbed, papillate. *Bracteoles* 2.3-4.0 x 0.5-1 mm, scarious, with a narrow pale brown midrib. *Floral tube* obconic, usually 2-2.5 mm long, papillate above the ovary; *ovary portion* 1-1.5 mm long, prominently rugose with horizontal protrusions. *Sepals* 0.3-0.7 mm long, rounded. *Petals* white, ovate, 1.8-2.3 mm long. *Stamens* mostly 0.4-0.7 mm long. *Staminodes* narrowly triangular or triangular, 0.2-0.35 mm long. *Ovules* 2. *Style* 4-6 mm long; *substigmatic hairs* forming a band 0.5-1 mm long. *Seeds* solitary, c. 1 mm long. *Haploid chromosome number* = 12 (Rye 1979).

Other specimens examined. WESTERN AUSTRALIA (all PERTH): East of Tardun [c. 28°50′S, 115°50′E], *J. S. Beard* 6696; Bullardoo Station [27°51′S, 115°40′E], *J. S. Beard* 6865; South of Coolcalalaya [c. 27°35′S, 115°03′E], *J. S. Beard* 7148; Paynes Find [29°28′S, 116°18′E], *H. Demarz* 2763; Pindar [28°28′S, 115°47′E], *C. A. Gardner* 7777; Perenjori [29°28′S, 116°18′E], October 1945, *C. A. Gardner* s.n.; Morawa [29°13′S, 116°01′E], December 1962, *C. A. Gardner* s.n.; East of Sandstone [c. 27°60′S, 119°45′E], 26 October 1963, *C. A. Gardner* s.n.; Kalbarri National Park [27°34′S, 114°26′E], *R. J. Hnatiuk* 780366; Pindar, 20 September 1968, *M. E. Phillips* s.n.; Paynes Find, *B. L. Powell* 73012; North of Mount Magnet [27°58′S, 117°50′E], *B. L. Powell* 74045; North of Morawa [c. 29°10′S, 116°00′E], 16 November 1958, *L. Steenbolm & F. Lullfitz* s.n.; Unknown locality, *E. Wittwer* 1596.

Distribution. Western Australia, from Kalbarri National Park south to Perenjori and east to the Sandstone area (Rye 1983, Figure 1), a range of over 500 kilometres.

Habitat. Mostly recorded in sandy soils, sometimes associated with *Acacia* thickets. At Mount Magnet the species occurred on a breakaway.

Flowering period. August-November.

Derivation of name. From the Latin diminutive of capitulum, referring to the small flower heads.

Discussion

Darwinia capitellata apparently differs from all other members of the genus in its possession of well developed compound inflorescences (superconflorescences). At first glance, the corymb-like compound inflorescences appear the same as the heads (conflorescences) of other species, such as *D. diosmoides.* In *D. diosmoides,* the heads are usually solitary, terminating leafy shoots; when, very rarely, 2 or 3 heads arise close together, they do not appear to merge into a corymb as in *D. capitellata.*

Darwinia diosmoides also differs from *D. capitellata* in its lack of obvious oil glands on the stems. Its bracteoles tend to be much more leaf-like than in *D. capitellata*, with thick fleshy midribs and narrow scarious margins.

Acknowledgements

I am grateful to Professor K. H. Rechinger for providing the Latin diagnosis and Mr P. G. Wilson for constructive criticism of the manuscript.

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A new Western Australian species of *Pandanus* subgenus *Pandanus* section *Semikeura (Pandanaceae)*

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Abstract

Stone, Benjamin C. A new Western Australian species of Pandanus subgenus *Pandanus* section *Semikeura* (Pandanaceae). Nuytsia 4(3): 427-433 (1983). *Pandanus rheophilus* Stone, belonging to subgenus *Pandanus* section *Semikeura* Stone, is described as a new species from Western Australia. It was discovered along streams on the Mitchell Plateau, near the Mitchell River Falls, in the north Kimberley region. It can be distinguished from the other taxa of the section by its larger drupes with longer endocarps.

Introduction

Recent botanical collections in the Mitchell Plateau area of the Kimberley region, north-west Western Australia, included specimens of a streamside pandan which pertained clearly to subgenus *Pandanus* section *Semikeura* Stone (1974) but which differ in several respects from all previously examined material of this section. Although the staminate plants have not been found, the fruiting material permits the recognition and the following description of this interesting new species.

Pandanus rheophilus Stone, sp. nov. (Figures 1-4)

Arbor usque ad 6 m alta, ramosa, ramis paucis divergentibus, modice elongatis, coronam foliaceam ferentibus. *Folia* attenuato-loriformia, pallide viridia, concoloria, usque ad 130-?140 cm longa, 6.3 cm lata, suberecta, apicem versus sensim attenuata, in flagellum inerme vel subinerme excurrentia; marginibus basi denticulis aciculiformibus antrorsis c. 3 mm longis, c. 6-12 mm dissitis; in medio denticulis similibus appressioribus et brevioribus c. 1-1.5 (-2) mm longis, c. 3-10 mm dissitis; apice c. 0.5—0.75 mm longis et 4-9 mm dissitis; denticuli in flagello sensim infrequentiores vel nulli. *Costa mediana* dorso denticulis antrorsis provisa, basi et in medio denticulis ad eos in margine adjacenti simillimis, apice et in flagello brevioribus et sensim remotius 8-27 mm dissitis, in extremo nullis. *Inflorescentia* terminalis. *Cephalium* pendulum globosum c. 18 cm diametro, e plurimis drupis (circiter 364-373) compositum, pedunculo c. 20 cm longo. *Drupa* unilocularis (rariter bilocularis, rarissime trilocularis) c. 6.7 cm c. 6.7-8 cm longa ad 1.5-2.5 cm lata, anguste cuneata, pileo acute pyramidali vel obtuse rotundato, vertice subconcavo, angulato c. 1 cm alto, stigmate obliquo ovato brunneo 2 mm longo terminata. *Mesocarpium* superum 27 mm longum, dense medulloso-fibrosum; inferum 8 mm longum, fibroso-pulposum. *Endocarpium* fusiforme, in parte dimidio inferiore locatum, 30 mm longum, 9 mm crassum, osseum, pariete ad 2 mm crasso. *Semen* fusiforme, 16 mm longum, endospermio albo. *Cetera* ignota.

Figure 1. *Pandanus rheophilus*. Habit of fruiting tree. (From *K. F. Kenneally* 7754, the type.)

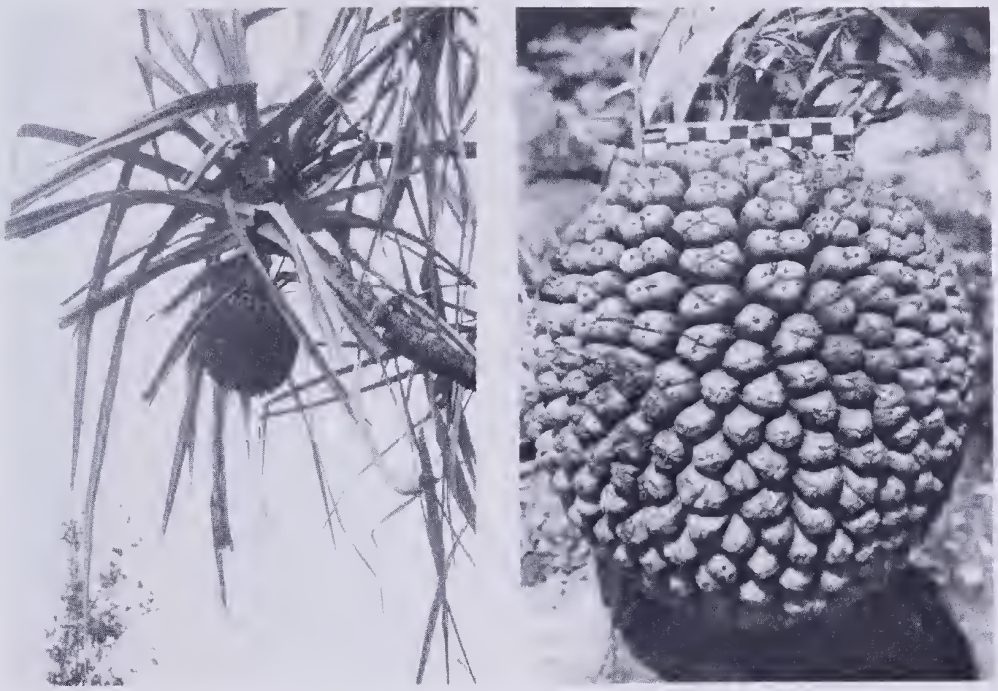

Figure 2. *Pandanus rheophilus*. A—Cephalium of *K. F. Kenneally* 7754 (the type). B—Cephalium in closer view showing the simple, bilocular and trilocular fruits. Note that the simple drupes are concentrated at the apex of the cephalium as is normal. Scale in cm. Photograph of *K. F. Kenneally* 8677.

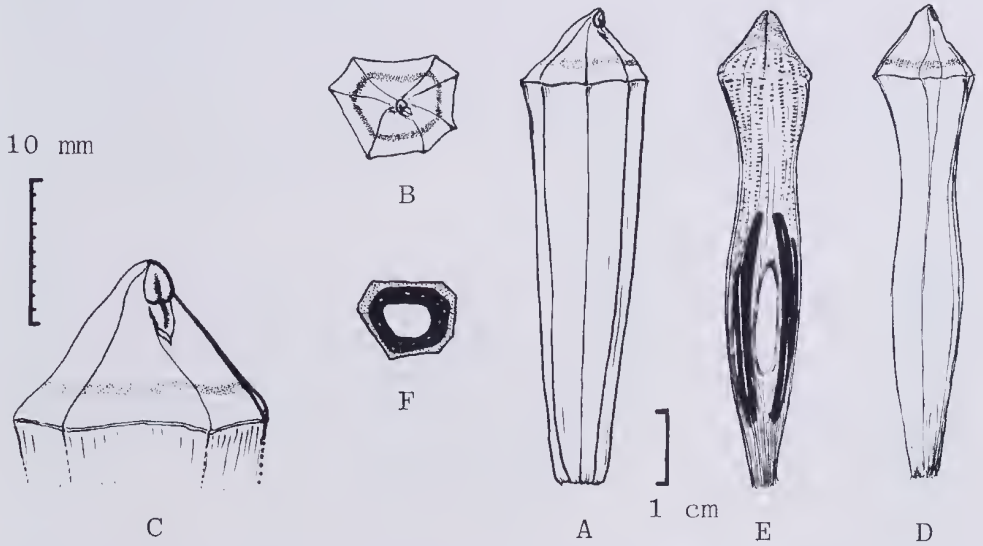

Figure 3. *Pandanus rheophilus*. Details of the fruits. A—Ripe drupe, fresh, in profile. B—The same in top view. C—The same, detail of pileus showing stigma and faint collar. D—Ripe drupe, dry, in profile. E—The same, in longitudinal section; endocarp in black, seed white. F—The same, trans-section of endocarp at midpoint. (All from the holotype, *K. F. Kenneally* 7754.)

Typus: Unnamed creek 9 km NW of Mitchell River Falls, 14°46′40″S, 125°37′20″E, north Kimberley, Western Australia. "Erect screw pine to 6 m. Leaves pale green. Fruits large. Phalanges orange when ripe. Common fringing ephemeral creek flowing amongst massive King Leopold Sandstone." 15 Jan 1982, *K. F. Kenneally* 7754 (holo: PERTH; iso: KLU).

Tree up to 6 m tall, branched, the branches rather few, diverging, moderately elongated, bearing the crown of leaves. *Leaves* narrowly strap-shaped, gradually narrowed to the prolonged slender apex, pale green, up to about 130-140 cm long, to 6.3 cm wide, erect to drooping. *Leaf margins* toward the base with acicular forwardly directed teeth about 3 mm long, and 6-12 mm apart; toward the middle, with similar but more appressed, shorter teeth, about 1-1.5 (2) mm long and 3-10 mm apart; toward the apex the teeth still smaller, about 0.5-0.75 mm long, and 4-9 mm apart; on the flagellum, the teeth gradually sparser or lacking. *Midrib* on dorsal side provided with forwardly directed teeth, at and near the base and near the middle similar in size and spacing to those of the adjacent margins, along the apex and the flagellum slightly shorter and successively more distant, 8-27 mm apart, at last absent. *Inflorescence* terminal, the pistillate head solitary, pendulous, globose, about 18 cm in diameter, composed of numerous (about 364-373) mostly 1-celled (rarely 2- or very rarely 3-celled) drupes. *Drupe* about 6.7-8 cm long, c. 1.5-2.5 cm wide, narrowly cuneate, the pileus acutely pyramidal, about 1 cm high, terminating in the oblique ovate brown 2 mm long stigma. *Upper mesocarp* 27 mm long, densely medullose-fibrous. *Lower mesocarp* 8 mm long, pulpy-fibrous. *Endocarp* fusiform, situated in the lower half of the drupe, 30 mm long, 9 mm thick, bony, dark brown, the walls c. 2 mm thick. *Seed* fusiform, 16 mm long, the endosperm white. Other details unknown.

Other collection examined. Unnamed tributary to the Mitchell River, North Kimberley, (14°45′S, 125°38′E) Common fringing ephemeral creek flowing amongst massive King Leopold Sandstone; screwpine to 6 m; leaves blue-green; old inflorescences remaining attached to stem; fruit (cephalium) large consisting of 364 drupes (plus 8 two-celled and one three-celled phalanges). 8 December 1982, *K. F. Kenneally* 8677 (KLU, PERTH).

Derivation of the name. From Greek, *rheos* = stream, *philo* = to love, hence *rheophilus*, a stream-lover, in allusion to the ecology and habitat of the species.

Discussion

Of the five species so far described which are consectional under subgenus *Pandanus* section *Semikeura* Stone, two have so far been reported from Western Australia (*P. kimberleyanus* H. St. John and *P. aquaticus* F. Muell.). In my review of this section, which included its first description, I explained why most of the described species should be regarded as likely synonyms of the earliest named member of the group, *P. aquaticus* F. Muell. (Stone 1974). Previous collections from Western Australia were few. Three of these, all by W. V. Fitzgerald, collected in 1906, were assigned by St. John to his new species *P. kimberleyanus* (St. John 1961). All these collections were from the same locality, the Fitzroy River. Although in my review of section *Semikeura* (Stone 1974) I regarded *P. kimberleyanus* as perhaps a synonym of *P. aquaticus*, I remarked that the former was "better qualified than the other taxa for ranking as a subspecies." This and the other three taxa (*P. delestangii* Martelli, from Queensland, *P. spechtii* H. St. John, from Northern Territory, and *P. oblanceoloideus* H. St. John, from Queensland) all agree very closely in the chief diagnostic characteristics of the fruits. In particular, they agree in drupe size, this

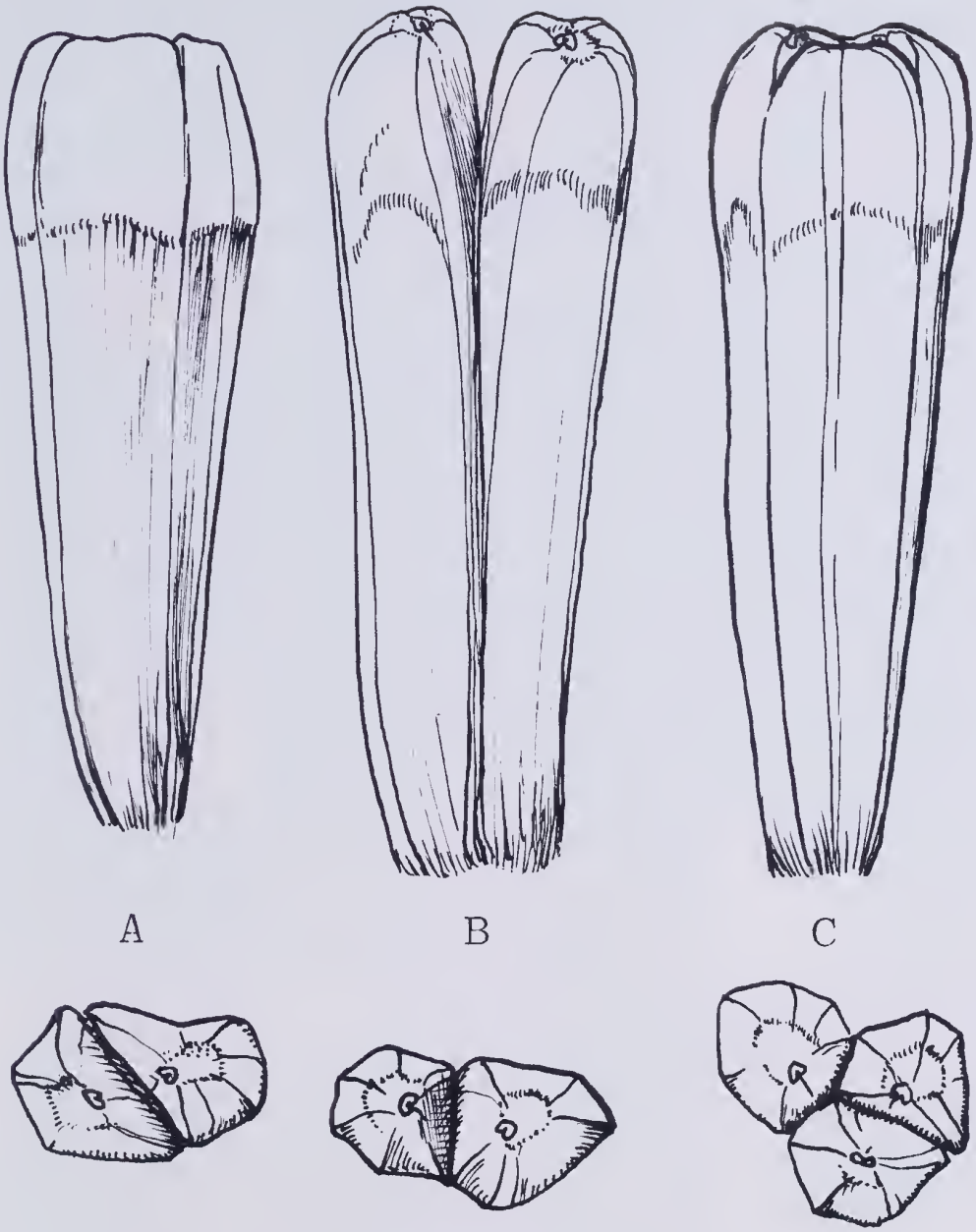

Figure 4. *Pandanus rheophilus*. Details of the fruits; two- and three-celled phalanges from *K. F. Kenneally* 8677. A—2-celled phalange with opposed carpels and unified apex. B—2-celled phalange with subopposed (nearly laterally paired) carpels with separate apices. C—3-celled phalange. Upper views show profiles, lower views corresponding top views.

being 35-44 mm long (31-35 mm for *P. delestangii*, 38-41 mm for *P. oblanceoloideus*, and 39-44 mm for *P. spechtii*). For *P. aquaticus*, no comparable measurements from the type specimen can be made since the type is a staminate specimen; but most probably the Queensland populations called *P. delestangii* and the Northern Territory populations called *P. spechtii* are the most similar to the original population sampled by von Mueller which furnished the type of *P. aquaticus*, which was in the Victoria River, Northern Territory.

The drupes of *Pandanus kimberleyanus* H. St. John are 25-28 mm long, and seem to be thus in a different size class. This taxon also has a somewhat different pileus form which is very low, rounded and with a small subconcave aerola at the vertex beside the stigma. For this reason, the taxon should perhaps be regarded as of specific or subspecific status.

In *Pandanus rheophilus*, the drupes are 67-80 mm long, and the drupe apex is broadly pyramidal to obtusely rounded-angulate with a subconcave vertex. The endocarp is slender, fusiform, elongated (30 mm long), and is located approximately in the lower half of the drupe. In all other described consectional taxa, the endocarp is central and much shorter, only 9-11 mm long. In these characters, *P. rheophilus* stands out, and species status seems amply justified despite the minimal representation of the taxon (only the type and one other collection are known so far).

The characteristics of the different described taxa can be noted in the tabular comparison (Table 1).

Table 1. Some drupe characteristics in section *Semikeura*.

Nominal Species	Drupe length	Drupe apex shape	Endocarp length/position
delestangii	31-35 mm	subacute-rounded	8-11 mm/submedian
oblanceoloideus	38-41 mm	acute to subacute—rounded	10-11 mm/submedian
spechtii	39-44 mm	acute to subacute—rounded	9 mm/submedian to slightly supramedian
kimberleyanus	25-28 mm	rounded with small concavity	7-8 mm/submedian
rheophilus	67-80 mm	conic-pyramidal to obtusely rounded—angulate with subconcave vertex	30 mm/subbasal, occupying lower half of drupe

From the data in Table 1, and from the descriptions of the taxa named, it seems useful for the time being to regard the three taxa, *P. aquaticus*, *P. kimberleyanus*, and *P. rheophilus*, as species. The other taxa previously described, *P. delestangii P. spechtii* and *P. oblanceoloideus*, should definitely be regarded as clear synonyms of *P. aquaticus*.

A key for the determination of the three species follows.

Key to species of section *Semikeura*

1. Drupes 25-28 mm long; endocarp submedian, 7-8 mm long; drupe apex rounded, with a small concave areola beside the stigma . . *P. kimberleyanus*
   Drupes longer, mostly 31-68 mm long; endocarp submedian or subbasal; drupe apex acute to subacute rounded or pyramidal 2

2. Drupes 31-44 mm long; endocarp submedian, 9-11 mm long; drupe apex acute to subacute rounded . . . . . *P. aquaticus*
   Drupes 67-80 mm long; endocarp subbasal, 30 mm long; drupe apex conic-pyramidal to obtusely rounded-angulate with subconcave vertex . . . . . *P. rheophilus*

Kenneally (pers. comm.) notes that in *P. rheophilus* (and specifically in his number 8677) the leaves are noticeably bluish green, while in *P. aquaticus* (and *P. kimberleyanus*) the leaves are a more yellowish-green.

Ecology

Further collections of this interesting group of species are needed in order to obtain data for further analysis concerning variability in fruit size in the various populations; to obtain staminate materials in more abundance to ascertain if staminate characters can be utilized to substantiate the taxonomic arrangement; and to provide an insight into whether there are any differences in vegetative characters between these taxa. Also desirable would be further ecological studies, as there seem to be some interesting correlations with fauna. St. John (1967) quotes A. de Lestang's letter to W. D. Francis which mentions details of phenology and habit, and describes the behaviour of white cockatoos (*Cacatua galerita*) which "systematically comb the *Pandanus* for syncarps; beginning in February, they tear down each drupe in quest of a kind of fly larvae . . . the greater part of the drupes fall in the water below where herds of turtles gluttonously swallow whole the falling drupes; those falling upon the banks are not lost either, for when all the *Pandanus* are clean of syncarps, the cockatoos search the ground carefully for the dry nuts and with their powerful beak crush and extract the edible parts." The mention of turtles is particularly significant here, since the riverine ecological preference and the drupe form both seem to suggest that ingestion of the drupes by turtles is likely. This relationship of pandans and turtles has been demonstrated in Malaya between the Perak River terrapins (*Batagur baska*) and the riverine pandan *Pandanus helicopus*. Fruit distribution in *Pandanus helicopus* is certainly due in part to consumption of drupes by the terrapins. The same may be true for the pandans of section *Semikeura*, including *P. rheophilus*.

Acknowledgements

I wish to thank Mr K. F. Kenneally, Western Australian Herbarium (PERTH), for providing the excellent photographs used herein.

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Angasomyrtus, a new genus of Myrtaceae (Leptosperminae) from Western Australia

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Abstract

Trudgen, M. E. and Keighery, G. J. *Angasomyrtus*, a new genus of Myrtaceae (Leptosperminae) from Western Australia. Nuytsia 4(3): 435-439 (1983). *Angasomyrtus* gen. nov. and *A. salina* sp. nov. are described and illustrated. The taxonomic position and distinguishing features of the new genus are discussed; its closest relatives are considered to be *Kunzea* and *Leptospermum*. Only three populations are known, two about 50 km north of Esperance, and a third 90 km north-east of Esperance. On present knowledge the taxon must be considered rare.

Angasomyrtus Trudgen and Keighery, gen. nov.

Frutex; partes juniores floresque sparsim puberulii. *Folia* opposita, parva, in extremis ramulis aggregata. *Flores* parvi, bibracteolati, sessiles. *Hypanthium* anguste turbinatum. *Calycis* lobi 5. *Petala* effusa. *Ovarium* hypanthio adnatum, 2 vel 3(4) loculatum. Placentatio axialis. *Stamina* non exserta, in verticillis duobus disposita; antherae dorsifixae, rimis parallelis dehiscentes. *Stylus* crassus inclusus. *Fructus* capsula ad hypanthium chartaceum adnata. *Semen* cylindricum; hilum parvum, terminale, testa membranacea, brunnea. *Embryo* rectus, cotyledonibus radiculam aequantibus; endospermium absens.

Typus: Angasomyrtus salina Trudgen and Keighery

Shrub, young growth and flowers minutely puberulent. *Leaves* opposite, small, clustered at ends of branchlets. *Flowers* small, bibracteolate, sessile, solitary in the axils of leaf-like bracts. *Hypanthium* narrowly turbinate, chartaceous. *Calyx lobes* 5. *Petals* 5, spreading. *Ovary* adnate to the hypanthium, not protruding, 2-3(4) locular. *Placentation* axile. *Stamens* 16-19, in 2 whorls, not exserted beyond petals; anthers dorsifixed, dehiscing in parallel slits. *Style* thick, not exserted beyond petals. *Fruit* a capsule, narrowly turbinate, adnate to the chartaceous hypanthium. *Seeds* cylindrical, pendulous; hilum small, terminal, testa papery, brown. *Embryo* straight, the cotyledons equal to the radical, endosperm absent.

Generic etymology. The genus is named after the co-discoverer, Mr Angas Hopkins, who is known for his work on the ecology and conservation of the Western Australian flora.

Angasomyrtus salina Trudgen and Keighery, sp. nov. (Figure 1)

Frutex apertus effusus; rami juniores subtiliter et sparsim puberuli. *Folia* erecta, fasciculata, ad extremos ramulos tantum evoluta, anguste elliptica ad lanceolata, 4-6 mm longa, semiteretia. *Flores* bibracteolati. *Hypanthium* c. 2 mm longum. *Calycis* lobi erecti longitudine quartam partem hypanthii aequantes. *Petala* calyce 2 plo

longiora. *Ovula* 4-5 in quoque loculo. *Stamina* in verticillis duobus, exteriora erecta, interiora horizontalia, filamentiis abbreviatis. *Stylus* crassus, apicem versus gradatim contractus. *Capsula* vix aucta; stylus et calycis lobi persistentes. *Semina* pendula, testa membranacea, brunnea.

Typus: South of Truslove on reserve No. 27983 (8.6 km from northern boundary along central track), 33°23'S, 121°45'E, Western Australia, 8 Feb. 1977, *A. Hopkins* 77/27 and *M. E. Trudgen* (holo: PERTH; iso: K, CANB, NSW).

An open spreading *shrub* to 40 cm tall and 2 m across, finely and sparsely puberulent on the young branchlets, very young leaves and flowers. *Shoots* subtended by minute scarious cordate bracts. *Leaves* erect, clustered at the ends of the branchlets, narrow-obovate to elliptic, 4-6 mm long, concave above, smooth, yellow-green, gland-dotted; *petiole* 0.5 mm long. *Flowers* small, 4-6 mm across petals, solitary in the axils of leaf-like bracts, bibracteolate. *Bracteoles* scarious, ovate, clasping the hypanthium, caducous. *Hypanthium* about 2 mm long, narrowly turbinate. *Calyx lobes* 5, erect, narrow-cordate to semi-circular, ± 1/4 length of hypanthium. *Petals* spreading, suborbicular, about twice length of calyx lobes, very pale pink or white. *Ovary* adnate to hypanthium, 2 or 3(4) locular. *Placentation* axile from top inside corners of the loculi; *placentas* peltate; ovules 4-5 per loculus. *Stamens* 16-19 in two whorls; filaments terete, tapering from the base; inner whorl 0.2-0.4 mm long; outer whorl 0.4-0.6 mm long. *Anthers* dorsifixed, 0.2-0.25 mm long, 0.25-0.3 mm broad, loculi parallel, opening in parallel slits that converge towards the base; connective gland obovoid, pale. *Style* stout, shortly immersed, tapering slightly. *Stigma* a papillose surface on the truncated style apex. *Fruit* a capsule enclosed in a chartaceous hypanthium, apex expanding causing the style to become further immersed; stalks of placentas elongated across the tops of the loculi so that the seeds are pendulous in the fruit. *Seeds* more or less cylindrical, slightly broader at the chalazal end, 1-1.2 x 0.3-0.5 mm. *Testa* membranous to papery, dark brown with fine longitudinal ribs, oil glands absent. *Chromosome number*, 2n=22 (voucher: Reserve No. 27983, G. J. Keighery and M. E. Trudgen, PERTH).

Other collections examined. 10 km west of Wittenoom Hills, 15 Jan. 1978, *G. J. Keighery* and *M. E. Trudgen* s.n. (PERTH); Type locality, 15 Jan. 1978, *G. J. Keighery* and *M. E. Trudgen* s.n. (PERTH); Type locality, Jan. 1979, *C. Robinson* s.n. (PERTH); 6 km north east of Mt Heywood, *K. Newbey* 7918 (PERTH).

Distribution and habitat. Angasomyrtus salina grows in white sand dunes over clay at the margins of small playa lakes. At the type locality a sand dune rises gently from the lake floor and near the bottom of the dune *A. salina* occurs between a community of an unusual variant of *Tegicornia uniflora* P. G. Wilson and a *Melaleuca/Eucalyptus* shrubland. At the Wittenoom Hills locality the dune is truncated along the border of the *A. salina* belt and the *Eucalyptus/Melaleuca* community. Here *A. salina* occurs as scattered individuals at the edge of the shrubland which abuts directly onto the lake. Although playa lakes are common in the region north of Esperance, not many have marginal sand dunes, a habitat to which *A. salina* is restricted.

Flowering period. Angasomyrtus salina flowers from December to February. The exact time seems to be quite variable, for example, the type was collected in late flower in Feb. 1977 but when the same locality was revisited in Jan. 1978 all plants in the population had finished flowering. Subsequent visits have failed to secure good flowering material.

Figure 1. *Angasomyrtus salina*. a—Portion of branch; b—Adaxial view of leaf; c—Bracteoles on bud; d—Dormant terminal bud; e—Flower; f—Ovulodes; g—Fruit; h—Detail of placental stalk; i—Style TS; j—Style; k—Stamens; l—Seed showing ornamentation; m—Seed showing attachment to placenta (immature); n/o—Ovule. All drawn from *A. Hopkins* 77/27 and *M. E. Trudgen* (the type). Scale bar = 1 mm.

Conservation status. On present knowledge *Angasomyrtus salina* must be considered a rare species of restricted habitat and restricted range. As such, its continued existence may depend upon the Truslove Reserve population remaining undisturbed. Further clearing for agriculture could easily destroy the species at the other two known localities.

Specific etymology. The specific epithet refers to the saline habitat of the new species.

Relationships and delineations of Angasomyrtus. Within the Myrtaceae *Angasomyrtus* belongs to the tribe Leptospermeae (Bentham 1867) because its fruit is a capsule. Its position in this tribe appears to be in the subtribe *Leptosperminae* (syn. Bentham's (1867) "*Euleptospermeae*") or the *Leptospermum* alliance of Briggs and Johnson (1979) because of its straight embryo with the cotyledons equal in length to the radicle and the presence of scarious bracts subtending the dormant shoot apices. This is felt to be the most appropriate position even though the leaves of *Angasomyrtus* are consistently opposite, a rare character state for the *Leptosperminae*.

The closest relatives of *Angasomyrtus* within the *Leptosperminae* appear to be *Kunzea* and *Leptospermum* (see below). The new genus can be easily separated from *Agonis, Callistemon, Conothamnus, Melaleuca* and *Sinoga* because all of these genera have their flowers grouped in heads and have woody fruit. It can also be easily separated from *Lamarchea* which has a woody fruit and has its stamens fused in a tube.

The chartaceous fruits of *Angasomyrtus* appear to closely relate this genus to *Kunzea*. This relationship is further supported by the fact that some *Kunzea* species occasionally have opposite leaves on some shoots, solitary flowers and two whorls of stamens. *Angasomyrtus* differs from *Kunzea* in having consistently opposite leaves, non-exserted stamens, flowers in monads not united into heads, a narrowly turbinate (not ovoid or globular) hypanthium, and blastotelic and auxotelic inflorescences (*Kunzea*: blastotelic and anauxotelic).

While *Angasomyrtus* has a superficial floral resemblance to *Leptospermum* (flowers in monads, stamens not exserted, conflorescences blastotelic and auxotelic) it differs in its fruits. The fruit in *Leptospermum* is campanulate, generally more woody and five or more celled. It is noted, however, that in *Leptospermum* sect. Pericalymma the fruit is 3- (not 5-) celled and is narrower than in either sect. Leptospermum or sect. Fabrica. In these characters sect. Pericalymma superficially resembles *Angasomyrtus* (fruits 3-celled and narrowly turbinate). However, sect. Pericalymma has a very distinctive vegetative morphology and according to Briggs and Johnson (1979) probably deserves generic status.

Angasomyrtus can be further distinguished from *Kunzea* and *Leptospermum* by the nature of the placenta whose stalk elongates during development of the fruit. At the flowering stage the axile placenta is almost sessile, however by the time the seeds are fully developed the stalk of the placenta has elongated and the placenta has moved to the top of the loculus where it faces downwards (see Figure 1h). The position taken up by the placenta is presumably to accommodate the pendulous seeds (to 1.2 mm long) in the narrowly turbinate fruit.

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